



**DELHI UNIVERSITY  
LIBRARY**

# DELHI UNIVERSITY LIBRARY

Cl. No. 509

(10)

Ac. No. 151105

Date of release for loan

This book should be returned on or before the date last stamped below. An overdue charge of 5 Paise will be collected for each day the book is kept overtime.



## The Animal Mind



to  
The Gentle Reader

# The Animal Mind

By

C. Lloyd Morgan, F.R.S.

London

Edward Arnold & Co.

1930

Made and Printed in Great Britain by  
Butler & Tanner Ltd., Frome and London

## *Preface*

"What has become of the Gentle Reader?"

These are the opening words of an essay which gives its title to a delightful book by Mr. S. M. Crothers.<sup>1</sup> "One does not like to think," he says, "that the Gentle Reader has passed away with the stagecoach and the weekly news-letter; and that henceforth we are to be confronted only by the stony glare of the Intelligent Reading Public. Once upon a time, that is to say a generation or two ago, he was very highly esteemed. To him books were dedicated, with long rambling prefaces and with episodes which were their own excuse for being. In the very middle of the story the writer would stop with a word of apology addressed to the Gentle Reader, or at the very least with a nod or a wink. No matter if the fate of the hero be in suspense or the plot be inextricably involved.

"'Hang the plot!' says the author, 'I must have a chat with the Gentle Reader, and find out what he thinks about it.'

"And so confidences were interchanged, and there was gossip about the Universe and suggestions in regard to the queerness of human nature, until, at last, the author would jump up with, 'Enough of this, Gentle Reader; perhaps it's time to go back to the story.'

"The thirteenth book of *Tom Jones* leaves the heroine in the greatest distress. The last words are, 'Nor did this thought once suffer her to close her eyes during the whole succeeding night.' Had Fielding been addressing

<sup>1</sup> *The Gentle Reader*, by Samuel McChord Crothers (Boston and New York, 1903).

the Intelligent Modern Public he would have intensified the interest by giving an analysis of Sophia's distress so that we too should share her insomnia. But not at all! While the dear girl is recovering her spirits it is such an excellent opportunity to have uninterrupted discourse with the Gentle Reader, who doesn't take these things too hard, having long since come to 'the years that bring the philosophic mind'. So the next chapter is entitled *An Essay to prove that an author will write better for having some knowledge of the subject on which he treats.* The discussion is altogether irrelevant; that is what the Gentle Reader likes.

" 'It is a paradoxical statement you make,' he says, trying to draw the author out. 'What are your arguments?'

"Then the author moderates his expressions. 'To say the truth I require no more than that an author should have some little knowledge of the subject of which he treats.'

" 'That sounds more reasonable,' says the Gentle Reader. 'You know how much I dislike extreme views. Let us admit, for the sake of argument, that a writer may know a little about his subject. I hope this may not prove the opening wedge for erudition. By the way, where was it we left the sweet Sophy; and do you happen to know anything more about that scapegrace Jones?' "

The animal mind is my Sophy; perhaps, in a sense, that scapegrace Jones is the animal body. I am the author who ventures to claim some little knowledge of the subject of which he treats. You are the Gentle Reader, or, perchance, in these increasingly sophisticated days, a representative of the Intelligent Reading Public. I assume that, to you, years have brought the philosophic mind; and that, for you, some gossip about the Universe and the queeriness of human nature will not come amiss.

You, too, may dislike extreme views; you, too, may hope that the wedge of erudition may not be driven in too far. But, I suppose, just how far you will resent such erudition as you may stigmatize as technical, depends on your level of sophistication. You may tolerate more of it in physics than you are prepared to tolerate in psychology.

The trouble is that I have to put myself in your place that I may surmise what you wish me to give and are ready to take. I surmise that what you want, as Gentle Reader more or less 'sublimated', is a broad discussion of the place of the animal mind in the general scheme of things, rather than anecdotal descriptions of surprising occurrences on the one hand, or, on the other hand, too detailed an array of observational data with the inference which this or that psychologist has drawn from them. In a word, I take you to be a generalist, whose aim is to get a wide survey of the advance of knowledge, not a specialist in training to contribute something new along a particular line of advance. But you turn to specialists, along many lines, for up-to-date information, translated, so far as is possible, into language which can be understood with a little trouble and care. Such, I assume, are you, whom I hope to enlist among my readers.

And what of myself as writer? As a matter of history, in the closing decade of last century—within what Professor Whitehead characterizes as one of the dullest stages of thought since the time of the First Crusade—I wrote three books which Mr. Edward Arnold published. They were *Animal Life and Intelligence* (1889-90), *Habit and Instinct* (1896), and *Animal Behaviour* (1900). All are now out of print; but they may be found on the shelves of some libraries. A new edition of any one of them is out of the question. But we think that, as a sequel after thirty years, a new book on *The Animal Mind* may take up the running.

To the barren eighties and nineties of last century Mr.

Whitehead assigns at least one bit of good work directed to the end of furthering the absorption of the doctrine of evolution as guiding the methodology of all branches of science. But the Gentle Reader's attitude to evolution then was in many respects different from that of his successor to-day. In some respects my attitude now differs from what was my attitude then.

In the late nineteenth century, and since, I have been concerned to advocate certain views—a general world-outlook—abhorrent to some folk, not unwelcome to others. I am prepared to advocate them still, perhaps in a form less crude. But in the pages that follow my aim will be to seek some basis of agreement with my reader. Of course you, or another, may say: That is not a bit what I want. I want something I can go for tooth and nail, or some hefty stones I can throw at those with whom I am in hearty and bitter disagreement. Well, if so; so be it. I do, however, ask *you*, with whom I propose to discuss matters as Gentle Reader, to find, so far as is possible, some basis of agreement, and not, straight-away, throw insistent emphasis on divergence of belief—perhaps, as things are, inevitable in the long run, since such is 'the queerness of human nature'. Thus, I think, we may get on better together.

I propose to utilize some passages from the old books in so far as they may still, in my judgment, afford illustrative instances of what I shall have to say; in so far as they may throw light upon my erstwhile position; in so far as they bear on questions which are still live issues; and, sometimes, in so far as they seem to call for amendment. But the stress in this book will be on psychology rather than on biology—on mental relations rather than on the physical and physiological relations which, as we may agree, in some way accompany them in the life of animals.

I assume that we—you and I—are prepared to discuss

matters seriously. That must lead us at times, and, I fear, even near the outset, into deep waters. The waters of the mind—even the mind of your dog, horse, or pet guinea-pig—run deep, and are not easy to fathom. And the trouble is that these deep waters are hidden from view beneath the screen of behaviour which we *can* readily observe. That they are there and not otiose must be the first plank in our platform of agreement. This belief we must share if we hold in common that mental relations do in some way count in the affairs of animal life. We may have to confess, if we go deep enough, that it is a belief not susceptible of what a very rigid logician would regard as strictly proof. But it is a belief on which, in spite of meticulous logic, we all act.

I began this preface by quoting Mr. Crothers. Let me end with another quotation.

“When Don Quixote was descanting on the beauty of the peerless Dulcinea, the Duchess interrupted him by expressing a doubt as to that lady’s existence.

“ ‘Much may be said on that point,’ said Don Quixote. ‘God only knows whether there be any Dulcinea or not in the world. These be things the proof of which must not be pushed to extreme lengths.’ ”

Let us be Quixotic enough—and some behaviourists say that it *is* sheer Quixotry—to believe that our Dulcinea does exist.

C. L. M.





## *Contents*

CHAP.	PAGE
PREFACE . . . . .	v
I ENDS AND MEANS . . . . .	i
II PUT YOURSELF IN HIS PLACE . . . . .	21
III LEVELS OF MENTALITY . . . . .	40
IV SOME GOSSIP . . . . .	62
V LARGELY ANECDOTAL . . . . .	76
VI INSTINCTIVE BEHAVIOUR . . . . .	96
VII FURTHER REFLECTIONS . . . . .	116
VIII THE DAWN OF INTELLIGENCE . . . . .	132
IX ASSOCIATION . . . . .	151
X TRIAL AND ERROR . . . . .	169
XI MEMORY . . . . .	187
XII THE IGNORANCE OF ANIMALS . . . . .	208
XIII CHIEFLY PLAIN TALE . . . . .	221
XIV A GLANCE AT BODY-STORY . . . . .	234
XV ARE ANIMALS AUTOMATA? . . . . .	251
INDEX . . . . .	273

## Note

Reference to and quotations from some of the writer's other books will be given as under:

<i>A.L.I.</i>	. . .	<i>Animal Life and Intelligence.</i>
<i>H.I.</i>	. . .	<i>Habit and Instinct.</i>
<i>A.B.</i>	. . .	<i>Animal Behaviour.</i>
<i>P.T.</i>	. . .	<i>Psychology for Teachers.</i>
<i>I.C.P.</i>	. . .	<i>Introduction to Comparative Psychology.</i>
<i>I.E.</i>	. . .	<i>Instinct and Experience.</i>
<i>E.E.</i>	. . .	<i>Emergent Evolution.</i>
<i>L.M.S.</i>	. . .	<i>Life Mind and Spirit.</i>
<i>M.C.</i>	. . .	<i>Mind at the Crossways.</i>

I take the liberty of introducing a few verbal alterations and interpolations.

# *The Animal Mind*

## CHAPTER I

### *Ends and Means*

#### § 1

The first thing to do in approaching the study of the Animal Mind, or more strictly animal minds, is to get records of behaviour observed with due care. If they can be confirmed in like instances by observations of one's own, so much the better. Then in each instance we may 'draw inferences' as to what may have 'passed through the mind' of the animal as he behaved in this way or in that.

Rather unusual and unexpected instances of behaviour arrest our attention. Let us take, to begin with, two such instances of a dog's behaviour which may serve to bring out some of the problems that face us. Charles Darwin in the *Descent of Man* tells how "Colonel Hutchinson relates that two partridges were shot at once, one being killed, the other wounded. The latter ran away, and was caught by the retriever, who on her return came across the dead bird. 'She stopped, evidently greatly puzzled, and after one or two trials, finding she could not take it up without permitting the escape of the winged bird, she considered a moment, then deliberately murdered it by giving it a severe scrunch, and afterwards brought away both together. This was the only known instance of her ever having willingly injured any game.' "

The other instance given by Darwin in this connection is that reported by Colquhoun, 'who winged two wild ducks which fell on the opposite side of the stream. His retriever tried to bring both over together, but could not succeed; she then, though never before known to ruffle a feather, deliberately killed one, brought over the other, and returned for the dead bird.'

One naturally compares the retriever's procedure in the two cases. Commenting on the former, Darwin says: "Here we have reason, though not quite perfect, for the retriever might have brought the wounded bird first and then returned for the dead one, as in the case of the two wild ducks." And he adds: "I give the above cases as resting on the evidence of two independent witnesses, and because in both instances the retrievers, after deliberation, broke through a habit which is inherited by them (that of not killing the game retrieved) and because they show how strong their reasoning faculty must have been to overcome a fixed habit."

A further and much later comment may be cited.

Mr. Horace Hutchinson says that he asked his father "whether it were not possible, and likely that the dog, after an attempt or two to retrieve the two birds together, had given way to an impulse of irritation, had crunched his teeth, in that moment of temper, on the offending struggler, and so, incontinently, had found for the problem a solution which had all the appearance, to the human onlooker, of being rational. . . . After all," he adds, "the scrunch is only a return to the natural instinct of the dog—the original sin which had been beaten out of him by training him." Colonel Hutchinson 'was not at all disposed to be dogmatic in opposition to' his son's interpretation. "He quite admitted that it might have been thus that the seeming act of reason was performed. As to the 'deliberation' attributed to the act, he was perfectly ready to concede that this might have been an

illusory appearance, at the distance from which the drama was witnessed."

I do not wish to seem hypercritical. But I should not here speak of the deliberation attributed to the dog as 'an illusory appearance' at the distance from which the drama was witnessed. The meaning no doubt is clear. None the less what Colonel Hutchinson 'witnessed from a distance' was the dog's *behaviour*, not the *deliberation* as something that went on in her mind. This I say thus early, because it is important to distinguish behaviour which one *can* see, from mental process which one *cannot* 'see' in the same sense of the word.

These instances are noteworthy in that in each case the behaviour was unique. At all events, the implication is that this was the first occasion of such performance. One would like, however, to get behind the scenes. Is one sure that nothing similar occurred in the course of the retriever's previous training? One does not know the life history of either of these dogs. One has 'this occasion'; but what about previous occasions under circumstances in some measure similar?

## § 2

Much has been written on the training of domestic or of partially domesticated animals. Thirty years ago I wrote [*A.B.* 271]: Those who have seen a shepherd's dog at work on a moorland fell, and have taken the trouble to ascertain how the results have been attained, will appreciate, on the one hand, how well the dog knows and responds to the signals of his master, and, on the other hand, how completely all initiation is in the master's mind, not that of the keenly intelligent dog. Those who merely witness such a performance without inquiry or investigation will probably misunderstand the whole matter.

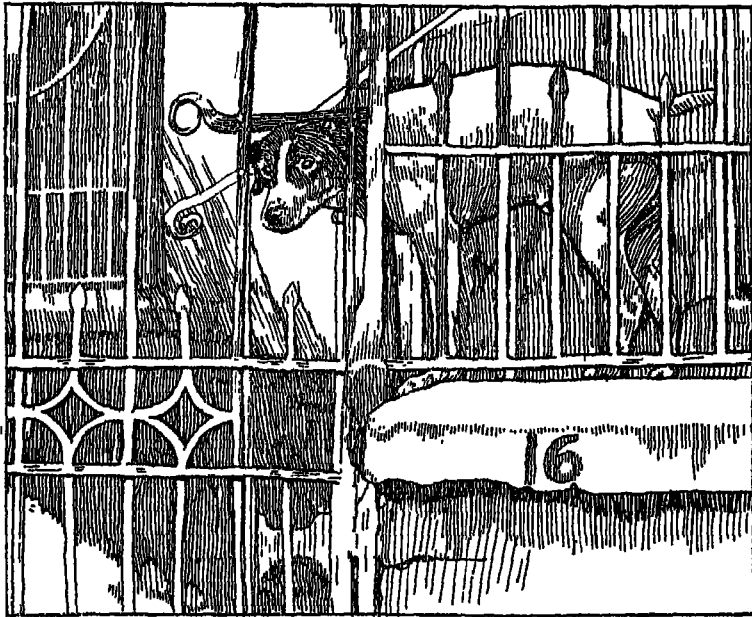
In the north of England competitions are not uncommon where, say, three sheep have to be driven over a definite course, between certain posts and round others, through narrow passages and into a small 'fold'—all within a certain time limit. At such a competition success depends on two things; first, the training of the dog to respond at once, say, to some six or eight whistle signals, often accompanied by gestures; and secondly, the judgment of the shepherd. The signals with different inflections have for the dog meaning, such as drive straight on, from this side, from that, stop, lie down, creep forward, and so forth. The dog's whole business is to obey these signals. And the instant response of a well-trained dog is admirable. But throughout he is merely the executant of his master's orders. He originates no important step. And if you listen to the criticisms by other shepherds during a competition you will find that they are mainly passed on the judgment shown by the master, and only, in palpable failures in obedience, on the behaviour of the dog. The intelligent animal is what he is trained to be—one whose natural powers are under the complete control of his master, with whom the whole plan of action lies.

In criticism of this statement I should now say that it seems to imply that there was no plan in the dog's mind, whereas the more cautious inference is that, for success from the master's point of view, and to attain his end in view, the dog's plan must be subordinate to his plan. That, however, is not now the point. The point now is that the trainer gets some insight into what, as he believes, goes on in the dog's mind, not on one occasion only but during a long series of occasions. But since the shepherd is presumably not a trained psychologist, he bases what he tells us on common-sense belief as to the nature of the dog's mind.

Let us now introduce the psychologist in some measure

trained to the task of interpreting mental processes. He starts with some instance of behaviour, preferably observed by himself, and tries to get behind it so as to tell us what, as *he* believes, goes on in the mind of the animal.

The way in which my dog learnt to lift the latch of the garden gate and thus let himself out was on this wise



[A.B. 144]. The iron gate is held to by a latch, but swings open by its own weight if the latch be lifted. Whenever he wanted to go out the fox terrier raised the latch with the back of his head, and thus released the gate, which swung open. Now the question in any such case is: How did he learn the trick? In this particular case the question can be answered, because he was carefully watched. When he was put outside the door, he naturally wanted to get out into the road, where there



was much to tempt him—the chance of a run, other dogs to sniff at, possibly cats to be worried. He gazed eagerly out through the railings on the low parapet wall shown in the illustration [*A.B.* 145, *Fig.* 21]; and in due time chanced to gaze out under the latch, lifting it with his head. He withdrew his head and looked out elsewhere; but the gate had swung open. Here was a fortunate occurrence arising out of the natural tendencies of a dog. But the association between looking out just there and the open gate with a free passage into the road is somewhat indirect. The coalescence of mental processes in a conscious situation effective for the guidance of behaviour did not spring into being at once. Only after some ten or twelve experiences, in each of which the exit was more rapidly made, with less gazing out at wrong places, had the fox terrier learnt to go straight and without hesitation to the right spot. In this case the lifting of the latch was unquestionably hit on by accident, and the trick was only rendered habitual by repeated association in the same situation of the chance act and the happy escape. Once firmly established, however, the behaviour remained constant throughout the remainder of the dog's life, some five or six years. And, I may add, I could not succeed, notwithstanding much expenditure of biscuits, in teaching him to lift the latch more elegantly with his muzzle instead of the back of his head.

Here again I might now express my interpretation more cautiously. What I wish to stand out is this: that in some sense of the words Tony had, as I believe, an end in view, or 'objective', namely to get out into the road; but that he had not at the outset, before gazing out here, there and elsewhere, discovered the means by which this end in view could be attained. Now the *outcome* of the completed behaviour, lifting the latch and getting out into the road, was such as anyone who

chanced to pass by might readily observe. I sought to ascertain through what progressive steps this outcome was reached. The point here is that observation on one occasion only, no matter how careful and exact that observation may be, does not suffice for the interpretation of this or that instance of animal behaviour.

### § 3

I spoke above of Tony's end in view—to get out into the road—and of his discovering the means by which this end in view could be attained. I spoke, too, of the *outcome* of his behaviour as that which could be observed, and of the progressive steps through which the completed outcome was reached. May I now say that the completed behaviour implied a 'plan of action' *in the dog's mind*? I seek thus to distinguish the bodily activities which one can observe from the mental activities which, rightly or wrongly, we attribute to him. I am, for the present, asking questions, not giving answers.

And may I go a step farther? May I speak of a 'fore-plan of action'—say in your mind or mine—when the plan is precedent to its execution in behaviour or conduct? And may I thus raise the question whether there was in Tony's mind a fore-plan of action? You may say: Of course there was. But let us go back to the evidence.

On the evidence, it may be said, when Tony had learnt the trick of the gate, then, at any rate, he had in his mind a fore-plan of action for the guidance of his behaviour under like circumstances on all subsequent occasions. Yes, that is so in a sense, and a sense that is obvious enough. As one might put it: When he had learnt how to act he knew how to act; in other words he had in mind a plan of action. But he had to learn how to act through behaving in this way and that; and the upshot

then seems to be that his 'plan' was to act in this way and not in that way. If, then, we believe that in due course he had a plan in mind, this plan was *subsequent* to behaviour in this way and that. But what I mean by a fore-plan is *precedent* to behaviour in this way or in that.

Let us take 'in this way or in that' pretty literally. The ways in which he thus behaves can be described under careful observation. Of course Tony behaved in hundreds of other ways under differing circumstances in the varied situations of his life. Some of these I have placed on record with sufficiency of detail. But at the gate there was no presumptive evidence that, precedent to the *first* of a series of occasions, there was a fore-plan of acting in this way and not that so as to attain the end he had in view.

Is it to be expected that he had in mind such a fore-plan? In this situation at the gate perhaps not. But take another situation in a pond. On the first occasion when he was gently lowered into the water by the scruff of his neck he swam passably well. What was his end in view? To save himself from drowning? What knew he about drowning? Let us say that his 'end in view' was to get back to me on the plank-platform. Had he a fore-plan of action—that behaviour which we call swimming? No, it may be said; the act was purely instinctive. Some may add that such an act is purely biological. Does this mean that there was nothing *ad rem* in Tony's mind on the occasion I have cited? I believe that there was; but if so the act was not *purely* biological.

Questions are here raised which will hereafter be discussed. One such question is whether instinctive behaviour, if it does imply mind in the animal, does also imply a fore-plan of action? Does it imply even an end in view? Some confidently reply that the answer is Yes.

Others, with equal confidence, assert that the answer is No. To say the least of it, this shows that we shall have to reckon with differences of opinion.

My present aim is to state what I mean by a fore-plan of action. The expression may be unfamiliar. But it is often helpful to state old problems in new ways. Just now we are concerned with what we can observe, and with such inference with reference to the animal mind as we are wont to draw from it. To this end let us take one or two other instances recorded of dogs.

Several observers have described how dogs which had occasion to swim across a stream entered the water at such a point as to allow for the force of the current. And two independent witnesses communicated to G. J. Romanes, who was then (1880) collecting evidence illustrative of animal intelligence, of a dog's observing whether the tide was ebbing or flowing, and acting accordingly.

Had the dog a fore-plan of action in mind, and, if so, how did it come there? He may on some first occasion have aimed at a suitable landing-place, been carried beyond it, and had trouble with rushes, or mud, or a steep bank. On subsequent occasions he may have allowed more or less nicely for the drift of the tide. One needs further information. If he learnt the trick in this way his behaviour was similar in principle to that of Tony at the gate. But there would be far nicer delicacy in perceiving the nuances of similar but differing situations.

I was unable to devise experiments with my fox terrier to see how he would behave in like circumstances. The few that I made were quite inconclusive. So I had to deal with nuances of other situations. The results are on record [*A.B.* 146], but they may here be cited since they bear on the matter in hand.

## § 4

I watched Tony's behaviour when a solid indiarubber ball was thrown gently towards a wall standing at right angles to its course. At first he followed it close up to the wall and then back as it rebounded. So long as it travelled with such velocity as to be only just ahead of him he pursued the same course. But when it was thrown more violently so as to rebound as he ran towards the wall, he learnt that he was thus able to seize it as it came towards him. And profiting by the experience thus gained, he acquired the habit—though at first with some uncertainty of reaction—of slowing off when the object of his pursuit reached the wall so as to await its return.

When the ball was thrown so as to glance off at a wide angle from a surface, at first—when the velocity was such as to keep it just ahead of him—he followed its course. But when the speed was increased he learnt to take a short cut along the third side of a triangle, so as to catch the object at some distance from the wall.

A third series of experiments was made where an angle was formed by the meeting of two faces of rock. One side of the angle, the left, was dealt with for a day or two. At first the ball was directly followed. Then a short cut was taken to meet its deflected course. On the fourth day this procedure was well established. On the fifth, the ball was thrown so as to strike the other (the right-hand) side of the angle, and thus be deflected in the opposite direction. The dog followed the old course (the short cut to the left) and was completely non-plussed, searching that side, then more widely, and not finding the ball for eleven minutes. On repeating the experiment thrice, similar results were on that day obtained.

On the following day the ball was thrown just ahead

of him, so as to strike to the right of the angle, and was followed and caught. This course was pursued for three days, and he then learnt to take a short cut to the right. On the next day the ball was sent, as at first, to the left, and the dog was again non-plussed. I did not succeed in getting him to associate a given difference of initial direction with a resultant difference of deflection.

Such was my finding. Repeating the experiments with other dogs, none did so well as he did, but none was so quick-witted, or so keen at the game, as was Tony. Perhaps with more prolonged practice he might have learnt to start on the cue of the initial direction—a cue so obvious to a youngster with me that he repeatedly said: “You little fool; you can do it if you try.” In the case of my fox terrier—I do not say of all dogs—I think it improbable that his remarkably acute powers of perception were such as would have enabled him to allow for the ebb or flow of the tide at varying rate so as to enter the stream at different points.

But I did gain the impression from a long series of varied experiments with him and with other dogs, that they could in some measure apply what was learnt in ‘these’ circumstances to what was to be done in ‘those’. It remains an impression, and I cannot quote specific instances. Still I hold strongly that general impressions on the part of those who have spent years in careful observation and cautious inference should be given due weight. And as I read more recent observations on the higher apes, I see in their case more cogent evidence.

Suppose, then, that this is so; how stands the matter in terms of ends in view and fore-plan, assuming that these may be present in the animal mind? We must budget for the transference of *this* plan (to attain this end in view) to action suitable to the attainment of *that* end in view. If I may so put it, we must realize that there may be ‘cross-over’ from this plan to that behaviour,

There can be little doubt that this does occur in our own reflective procedure as adult human folk. Let me try to illustrate what I mean from what I may call the ball-situation and the stream-situation, putting myself in Tony's place.

I, Tony, have learnt to swim across a still pond and fetch things out of it; but I have no acquaintance with streams. Meanwhile I have been learning quite a lot in ball-situations. Among other things I have learnt this: that if I follow a swift-running ball up to a wall, and from the wall as it rebounds at an angle, I cannot soon catch it; but if I take a short cut I can make pretty sure of doing so. Putting it humanly, I have learnt that if the ball has to traverse two sides of a triangle I can meet it by traversing the third side of the triangle. In any case that is what I do. I have thus learnt the trick of the running ball. But on such occasions I have to take stock of the situation. There is, as part of it, a wall; and this deflects the course of the ball. If I had not learnt to take note of the wall I should never have learnt to make a short cut.

Then one fine day I come across a strange pond in the middle of which a ball is floating. That is all right. I have often swum out to a ball in a pond and fetched it. But wait a bit. I must take stock of the situation. This is a new sort of pond. The ball is moving gently past me from left to right. Balls don't do that in our pond, though ducks do. To have a good bark at a duck I short-cut to its course. But what about this ball? This is a funny pond. It looks as if the water was flowing. If so, the moving ball may merely be carried along by the flowing stream. In that case, I too, shall be carried along. No need for short-cutting.

Well; never mind the ball, which has drifted out of sight while I was 'making up my mind' what to do. I'll just swim across to the opposite side. That's simple

enough. But hold on a moment. If the water is flowing I shall be carried down with it. I had better start a bit to the left to allow for the stream. I shall swim straight across but my actual course in flowing water will be diagonal. I've never done it; but that seems the right thing to do. Anyhow, that's the fore-plan I have in mind. I'll put it to the test in action.

## § 5

Of course in putting myself in Tony's place, in this parable, I must 'wash out' such technical terms as 'triangle' and 'diagonal'; nay more, I must wash out nearly all words—all save 'ball', 'fetch', and a few more which a dog can 'understand' but not utter. One must take, then, what I suggested as carried out 'pictorially'. The salient point is, that if I were Tony I might negotiate the stream-situation without having ever had occasion to swim in flowing water. I might have a plan in mind to meet at sight a new situation. This plan in mind, as precedent to the behaviour it suggests, would be what I call a 'fore-plan'. It is such as to enable me to tackle this stream-situation 'in my head' before I grapple with it in the water. I mentally cross the stream before I dive into it. But this fore-plan is derivative, in a round-about way, from a plan of action appropriate to the ball-situation. If all goes well, one may, I think, say: There is 'cross-over' from that fore-plan to this behaviour.

But you, on your part, may say: (1) That I am only supposing what my own reflective procedure would be; yours would be quite different; (2) that it is unreasonable to suppose that any dog is capable of such reflective procedure as this; and (3) that, in any case, the plan of action is based on *some* behaviour, if not in this situation, still in other situations.

Under (1) and (2) we get into the very thick of things.



We have to consider our own mentality as human folk, yours and mine, and the dog's mentality as one of many animal folk, and to compare them. That is the task of comparative psychology; and let us for the present so leave it.

But under (3) a question arises which one may here at least open up. If one takes the whole life of man or dog from birth onwards, which comes first, fore-plan of action, or behaviour in *some* precedent situations? Since a fore-plan of action is based, as we commonly say, on knowledge of some sort, and since all behaviour is action of some sort, we may condense the question thus: Which comes first, knowledge or action?

Are you not, it may be said, taking us into rather deep waters? Yes; but if we are to take matters seriously, as I suppose you take physical matters seriously, we shall get there soon enough. So we may as well take a preliminary plunge near the outset of our inquiry.

From what has already been said it is, I hope, sufficiently clear that, in our adult life, all our reflective procedure is such as to lead us to say without hesitation: First knowledge and then action. But it seemed that knowledge on, say, *this* occasion was based on action on other and previous occasions. Hence it follows—does it not?—that, as we go back and back, action precedes knowledge. And there are certain first occasions of action, say those that we speak of as instinctive (of which the swimming of the dog is an example), where a special form of action is not preceded by any *ad hoc* knowledge. For it does not seem likely that Tony's experience of running about on land furnished a fore-plan for his action of swimming in water.

But, you may say, when he does swim, passably well, on the first occasion on which he is in the water-situation, he does so in accordance with that plan of *bodily* action we call swimming. Here we get into verbal difficulties.

This plan of bodily action may be in mind in the sense that he has experience of the water and experience in behaving as he does. But is this a *fore-plan* of action? By this word, to which I seek to make you accustomed, I mean a plan of action *precedent* to swimming, not only that experience which, no doubt, accompanies this behaviour.

You may still say that such instinctive action implies an inherited fore-plan—that is, inherited knowledge of how to swim. But you probably know that others say that it implies only a *bodily* form of action which is inherited.

I seek only at present to open up a question for future consideration. It is a live issue. Quite recently Professor Alexander has said: "All error in understanding what knowing is arises from holding the principle that our actions are determined by knowledge; that we first know and then act. All truth in these matters depends on recognizing the opposite principle that we know in and through acting."

Is that so? At all events it gives pause to thought. Is it so in the matter of Tony's swimming? Is it so when he lifts the latch of the gate? Is it so when a sheep-dog works on the fell? Is it so when a retriever kills a wounded bird? Was it so when Professor Alexander wrote the passage I have quoted? Is it so when you or I say emphatically, No or Yes on reading it? Let us bear these questions in mind as we proceed with our inquiry

## § 6

The question I have raised leads us into the region of controversy. And the controversy, in this and other matters, chiefly centres in principles of interpretation. Mr. Alexander speaks of holding this principle or that.

Of course this principle or that must be applicable to all particular instances, such as those which I selected at the close of the foregoing section. But if it be a principle of interpretation it is held to be universally true. And this principle, in our inquiry, goes pretty deep. It lays the foundation for an answer to this very general question: In the progressive course of world-events, has action been developed as a means to the attainment of knowledge as an end in view on the part of the actor; or has knowledge been developed as a means to the prosecution of action as the end in view?

As practical folk we may ask: Why not both? I want, let us say, to learn how to play billiards. To know how to do so is here my end in view. But I learn how to play through playing, not merely through watching others play. So action is the means to the attainment of knowledge. I am now at the table preparing to make a stroke. How I make it depends on the knowledge I have so far gained. So knowledge is a means to the attainment of action, say in pocketing the red. Yes, that is so. But to get down to a general principle we must think not only of billiards but of life. Did I start life, as an infant, on a basis of knowledge of some sort, or on a basis of action or behaviour in some form? That is the root-question with regard to the principle of interpretation we want to get down to. And to the question: Which comes first in life and mind? Some reply: Action comes first, and we know through action; others reply, knowledge comes first, and we act through knowledge.

For a man in the billiards-situation substitute Tony at the gate. The same question arises, but, as some think, with a difference. The billiard-player has knowledge of the game as an end in view and realizes that action is a means to the attainment of that end. Had Tony as an end in view knowledge of doing the trick? Did he realize that lifting the latch was the best means

to *that* end—to attain knowledge—through the success of his action? He may have been able to think of end and means as thus intimately related, each complementary to the other; or he may not. He may have just wanted to get out into the road and after a while found himself there.

This distinction is somewhat subtle. We shall have, sooner or later, to reckon with such subtle distinctions. But let us waive them for the present.

We start with behaviour or action observed with due care. Much of it we can account for in a pretty simple and obvious way if we credit the animal with such mind as enables him to perceive the situation. He perceives, let us grant, the situation as a whole; and what he wants is some alteration in the situation as a whole. Most of us are familiar with the 'Pears' advertisement-picture and with the legend: "He wont be happy till he gets it." Gets what? The soap of course. But also of course, since this is implied, what he wants, and will (let us hope) get, is the new situation—soap here in the bath—instead of the old situation—soap out there on the floor. And before he 'gets it' with his hands he may, 'in his mind', picture it as already gotten.

It is convenient to think in terms of situations, even if we talk in terms of things; and this probably accords with the more primitive modes of perception in little children and in animals. On these terms, under observation, we take note of situations which seem to present difficulties and watch how the animal overcomes these difficulties. But we do not rest content with a single occasion. We regard it as a clue to further observation; perhaps under experimental conditions. It is well, however, not too closely to combine training an animal, as Colonel Richardson trained dogs for war-work, with experimental observation. For what we seek to ascertain is how the animal behaves on his own initiative, not

on ours. We should therefore refrain from teaching him, though we should so arrange matters as to give full opportunity for him, through his perception, to grasp the situation as a whole.

There is nothing new in these hints as to method of procedure. I was led to adopt them, as others had done in the eighties of last century. The method is not new, as some younger folk are prone to suppose. But the application of the method is now much more refined.

I sent Tony, then fourteen months old, after a short stick into a field [*A.B.* 141, cf. *I.C.P.* 255]. He had to pass through vertical rails about six inches apart. On his return the stick caught at the ends. I whistled and turned as if to leave; and the dog pushed and struggled vigorously. He then retired into the field, lay down, and began gnawing the stick; but, when called, he came slowly up to the railings and stuck again. After some efforts he put his head on one side and brought the stick, a short one, through. After patting and encouraging him, I sent him after it again. On his return he came up to the railings with more confidence; but, holding the stick by the middle, he found his passage barred. After some struggles he dropped it and came through without it. Sent after it again near by, he put his head through the railings, seized the stick by the middle, and then pulled with all his might, dancing up and down in his efforts. Turning his head in these efforts, he at last brought the stick through. A third time he was again foiled; again dropped the stick; and again, seizing it by the middle, tried to pull it through. I then placed the stick so that he could easily seize it by one end and draw it through the opening between the rails. But when I sent him after it, he went through into the field, picked up the stick by the middle and tried to push his way between the railings, succeeding after many abortive attempts, by holding his head on one side.

Subsequent trials on many a walk yielded similar results. But the following summer, when I resumed the experiments, I was able with some guidance to teach him to bring a walking-stick to the railings, drop it, and then draw it through by one end. But even then, if he dropped it in an awkward position, he did not apparently grasp that, by gently moving the stick a little one way or the other, the difficulty could easily be overcome.

In experimenting [*A.B.* 143] in such ways as to observe how he behaved in seizing and carrying differently balanced objects I used (1) a straight stick the centre of gravity of which was at the middle; (2) a Kaffir knob-kerrie, with its centre of gravity about six inches from the knob; (3) a light geological hammer; and (4) a heavier hammer, in which the centre of balance was close to the head. The net result of the observations was that the best place for seizing and holding the object was hit upon in each case after indefinite trials; that after three or four days' continuous experience with one (say the knob-kerrie), another, (say the stick) was at first seized nearer one end; and that there was little indication of the dog's seizing any one of the four at once in the right place; that is to say, the locus of seizure was not clearly differentiated in accordance with the look of the object. I tied a piece of string, in later trials, round the centre of balance. But this, at the time of the dog's death, had not served as a sure guide to his behaviour.

Enough of Victorian Tony and what he had then taught his master. Well-devised observations on monkeys and apes have opened up new vistas of the reach and range of the animal mind, or of some animal minds—Consul's, or Sultan's, or another's.

It has, however, been said that the findings of observers in this field of inquiry are so much coloured by the outlook on the part of the finders, that the results indicate rather the idiosyncrasies of the observer than those of

the animal under observation. That is so. Colonel Richardson suggests that the mind of this or that dog is to a great extent the reflection of that owner to whom it belongs in the most impressionable stage of its life—the first few months. But it is so in a more radical sense. For one can 'know' the mind of any animal only by putting oneself in his place.

## CHAPTER II

### *Put Yourself in his Place*

#### § 1

I suppose we all know what we mean when we use the expression 'putting oneself in his place'. In the current affairs of human life one is doing it all day long. If you tell me of the round of golf you played yesterday afternoon, and how you negotiated the approach to the thirteenth green, I may be 'with you' because I have 'been there'. If I am not a golfer I am not much with you because I have not been there. I cannot appreciate your (rather stupid) ends in view or the (often ineffectual) means you adopt for their attainment. In any life-situation the more intimately I have 'been there' the more thoroughly am I 'with you'—in other words, the more fully can I put myself in your place.

But in thousands of situations of our daily life there is no need for you to tell me anything. I am literally with you. I have not only been there but I am there. My situation at the time being is closely similar to yours. And what I have in my mind is closely similar to that which you have in your mind. This implies—does it not?—that your mind is similar to mine. But how do I know that this is so? And is it so if we add 'in all respects'?

May I here substitute the word 'believe' for the word 'know'? May I say—since I wish to be careful in what I say—that I believe that your mind is in some respects similar to mine? May I add that I believe that Tony's mind was in some respects similar to mine?



May I go yet further and say that, in my belief, the mind of any animal is in some respects similar to mine? Were there *no* respects in which some animal—even a cockroach—is like me in mental regard, I should say that, in my belief, such an animal has no mind. If your belief so far accords with mine, then I take it that we may pass to the question: In what respects?

Let me revert to the difference of opinion between Mr. Horace Hutchinson and his father in respect of the retriever that killed a winged bird. Colonel Hutchinson believed that there was deliberation on the part of his dog, and Darwin expressed his belief that her behaviour afforded evidence of reason on her part. But Mr. Horace Hutchinson ventured to doubt. Why should he doubt? Had a man behaved as the dog behaved he would probably have raised no question as to deliberation on the man's part. Was it not owing to his belief that in *this* respect the mind of the dog differs from the mind of a man? He tells us that this was so. He tells us that he accepts a canon of interpretation on which I laid stress many years ago. We should not, I had urged in effect [*A.B.* 270, cf. *I.C.P.* 53], explain any instance of animal behaviour as the outcome of higher mental processes, if it can fairly be interpreted as the outcome of mental processes which stand lower in the order of mental development.

You may not agree that such a canon of interpretation is acceptable. That is not here the point. Let us seek a basis of agreement in beliefs which we share in common. Do you agree that there *are* mental processes which we may speak of as higher and lower, and that, in some sense, the mind of a man is higher than that of an ape, the mind of an ape higher than that of a dog, and so on down a scale of some sort? If so, these minds, though they are in some respects

similar, are in some respects different. It remains then to inquire what distinguishes this mind from that mind.

Towards the close of the last century it was customary to say that reason is distinctive of the highest minds; that minds lower in 'the scale' are intelligent only; and that, lower still, are minds that are merely instinctive. Thus three levels of mind—assuming that the instinctive was a level of mind and not only a level of bodily behaviour—were distinguished. In what follows hereafter I shall invite you to distinguish three levels; but I shall call them reflective, perceptive, and percipient (in a special sense of the last of these three words). For the present we may take percipience as equivalent to sense-awareness. Top-level minds are reflective, perceptive, and percipient. Mid-level minds are perceptive and percipient. Bottom-level minds, if such there be, are percipient only, having sense-awareness and no more. This may represent an order in the progressive development of mind. Thus at birth—or perhaps only before birth—I may have been no more than percipient in sensory awareness; as an infant in arms I may have been perceptive also; as a child of two or three years I may have entered on the reflective stage of my mental life.

Not improbably I here outrun the beliefs which you are prepared to accept, and you on your part may outrun the beliefs which I am prepared to accept. Then as we proceed together we must seek some beliefs which we can both accept.

Just now the question before us is: In what respects may we say that, if there be a mind there must at least be *this*? I think we may agree in the belief that there must at least be sense-awareness or percipience of some kind. But how does one get at this percipience in any other mind than one's own?

## § 2

In such a case as Tony at the gate, or in the winged-bird situation which faced the retriever, we believe without shadow of hesitation not only that the dog is percipient, say in seeing and touching, but also perceptive of certain definite objects of vision and touch, and perhaps smell, with which he had become acquainted, and towards which his behaviour was directed. The question discussed by Mr. Horace Hutchinson and his father was: Does the observed behaviour justify belief in that reflective procedure which the word 'deliberation' and other such words imply? They both believed that the dog had keen powers of perception. And so, I take it, do we. It may therefore seem strange to ask: How do we justify this belief? We commonly take it for granted, as standing in no need for justification. One so naturally puts oneself in the animal's place under the circumstances of the situation that to do so is a matter of course. None the less one *does* put oneself in his place and 'impute' to him perception and percipience like one's own.

I ask leave to use the word 'imputation' as a technical term. When I see some one doing this or that, I speak of imputing to him a 'motive' for so acting. He gives, let us say, a beggar a shilling, whereas some of our party give him a penny, others a curse. "A benevolent fellow," says Dick; "Not a bit of it," says Tom, "just swank"; while Harry reserves judgment. Which is right in his imputation, Dick or Tom? I ask leave to extend the use of this word so as to cover any sort of experience, no matter how simple or how complex, which one 'imputes' to another. On these terms I impute percipience and perception to a rabbit that munches a carrot. I can see him go for the carrot and eat it. But I cannot, in like sense, see either his

percipience or perception. These I impute to him in confident belief.

If you say that it is a matter of observation that he perceives the carrot as something good for eating, do you not mean that you observe his behaviour which is such as to lead you to impute to him experience which is like that which would be yours under similar circumstances? And if you speak of observing 'consideration' on the part of a dog before entering a stream, here or there, in accordance with the ebb or flow of the tide, do you not mean that, in this case too, you observe such behaviour as leads you to impute to him a mental attitude like that which, you feel sure, would be yours under similar circumstances?

It seems, then, that Colonel Hutchinson imputed reflective procedure ('reasoning') to the retrievers, and that Mr. Horace Hutchinson believed that it sufficed to impute to them some special mode of perception ('something less than reasoning'). But both imputed to them mental process of some kind, higher than simple sense-awareness or percipience. So far they were in agreement. Had they not been so far in agreement, would discussion of the topic have been in any measure profitable? For any profitable discussion should we not always seek some basis of agreement? Suppose some one lays it down that no distinction can be drawn between reflective and unreflective procedure; then all that is left to discuss is whether this is so or not. The retriever's behaviour merely serves to start a wrangle. For if one of them says: It is so; and the other says bluntly: It is not so; there is no basis of agreement for profitable discussion.

The question at issue here would be partly but not only a verbal one. Let me put a like issue in other words. Some may assert that no animal does anything without some end in view. Others may say: Many

animals do many things, and all animals do some things in the course of their life, instinctively, without any end in view. Can they discuss this without coming to some agreement as to what they are to understand by 'end in view' and by 'instinctively'? Here again it is not only what the *words* mean, for they are only conventional signs, but what, in the belief of each disputant, is essential to the very being of the mind he imputes to the animal.

Now there is room for disagreement as to the appropriateness of the word 'imputation' for use in the wide sense I suggest. You may, however, provisionally consent to this usage. I want to get down to what we speak of as 'matter of fact'. Is it the kind of thing we actually do? Do we attribute to animals some kind of experience in some measure similar to our own? If we can agree that we do so, we have thus far a basis for the discussion of animal psychology.

On this understanding imputation is a mode of that which I shall speak of as 'reference'. Reference, in the sense intended, is a relation between some one and somewhat. When Colonel Hutchinson tells us of his retriever's behaviour, *that* is the somewhat to which his description has reference. When he expressed his belief that the dog considered for a moment and then deliberately killed the wounded partridge, this consideration and deliberation imputed to the retriever was that to which the Colonel's reflective thought had reference.

In the sense intended reference is always from some mind to somewhat seen, described, thought of, and so forth. Imputation is that special kind of reference which distinguishes the subject matter of comparative psychology. Here, if I may so put it, the somewhat is a some one; that is, the somewhat referred to is another mind.

§ 3

Not only animal psychology but human psychology also is founded on reference under imputation. We must therefore, Gentle Reader, interchange some confidences on 'the queerness of human nature'.

Psychology has reference to other minds than one's own, and thus far implies imputation. But human psychology is founded also on first-hand experience.

When I am speaking of *my* experience on such and such an occasion, what I say implies first-hand experience. Similarly when my neighbour is speaking of *his* experience on such and such an occasion, what he says implies first-hand experience on his part. Thus I may tell you of the landscape bathed in sunshine I saw yesterday; you may tell me of the song of the Black-cap you heard early this morning. What each of us tells the other is based on first-hand experience.

But there is give and take between us. In a sense, and quite a good sense, I can describe what I saw in such wise as to lead you to 'see' it; and you can so describe what you heard as to enable me to 'hear' it. Each gives, under word symbolism, a bit of experience which was, awhile since, his, and was primarily gotten at first hand. In so far as he 'hears' or 'sees', this also is first-hand experience; for it is his 'seeing' or 'hearing'. So, alike in giving and in taking, each has first-hand experience. And yet neither has any first-hand experience save only his own.

None the less, under imputation, each attributes first-hand experience to the other. No one dreams in the course of conversation of not doing so. Why, then, all this pother? Because we want to get down to a psychological distinction of some importance—that between what one has in one's own mind and what one imputes to another as having in his mind. Is this a valid dis-

inction? You may at first be disposed to say: No. But may not this be because in the practical affairs of daily intercourse both are always on the *tapis* together, so closely connected under customary give and take, that it is not worth while to trouble about such distinction as there may be?

Let us provisionally assume that for psychological discussion this distinction may be helpful, and let us turn our attention to another distinction. Consider that which is commonly spoken of as sense-awareness. We may take the 'sense', on one side of the hyphen, to mean that which is primarily given under, say, touch, taste, or vision. We say that there is awareness of somewhat touched, tasted, or seen on the part of some one. That gives us the awareness on the other side of the hyphen.

Now for the distinction I propose to draw. It is that between somewhat touched, tasted, seen; and some one touching, tasting, or seeing. And I ask leave, for our psychological purpose, *to restrict the use of the word 'awareness' to the latter*. I shall speak of 'awareness *in*' touching, tasting, seeing; not of awareness *of* that which is touched, tasted, or seen. I shall speak of percipient 'reference to' that which is touched, tasted, or seen.

It may be said that one never has one without the other at any rate in so far as we are dealing with actual examples of touch, taste, and vision, when the somewhat is present to 'the senses'. That is so. In these cases they are always 'correlative'. But may it not be helpful to distinguish them, even if in these cases they are inseparable?

Revert then to our conversation with reference to the sunset scene and the Blackcap's song. You actually heard the one; I actually saw the other. But at the bidding of your description I 'heard' the Blackcap's

song though I did not actually hear it—that I can vouch for; and at the bidding of my description you may assure me that you ‘saw’ the colours of the sunset—let us say from a point of view familiar to both of us—though you did not actually see them. Here is another psychological distinction between the actual and that which is ‘revived in imagery’, visual or aural; but let that pass, important as it is. Does the other distinction—that between ‘reference to’ and ‘awareness in’ still hold good? I submit that it does. Here too there was reference *to* that which was given in imagery; and there was correlative awareness *in* imaging, aurally or visually. And if we went further and discussed the psychology of imagery there would still be reference *to* the topic under discussion and awareness *in* discussing it.

But our discussion might have reference to awareness. Then the position is rather peculiar. There would be reference to awareness and awareness in referring to it. This peculiar position where mind plays a double rôle, as that which is thought of and that which is thinking of it, is one of the characterizing features of reflective procedure. Human psychology has much to say about it. Does it come within the purview of animal psychology? That depends on whether we impute such reflective procedure to some animals or do not.

#### § 4

It seems, then, that in animal psychology we are faced by initial difficulties. For if we can only get at the minds of others by means of ‘reference under imputation’, does not doubt cast its shadow on our path from first to last? Let us frankly confess that it does. But let us ask what this pathway is to be. It is a pathway of belief. Colonel Hutchinson presumably still



believed that there was some reflective procedure on the part of his retriever. Mr. Horace Hutchinson ventured to doubt. But both father and son had a basis of agreement in the belief that something went on in the mind that each imputed to the dog.

Leaving demonstrative proof on one side as, in this matter, perhaps unattainable, it is essential that for profitable discussion we should start from some acceptable basis in belief. I have been led to the belief that in all animals, from the highest to the lowest, there is percipient reference to their surroundings, awareness correlative with such reference, and awareness in behaving in this way or that. You may not be prepared to go quite so far. You may say: I can see no more reason for supposing that a sea anemone (let us say) has what you speak of as awareness in behaving than there is for supposing that a sensitive plant, such as mimosa, has any awareness, or that it has any mental percipience in reference to its surroundings. In both these cases, you may say, a biological interpretation suffices.

Here, then, there is no common basis of agreement in belief. Still I suppose you will agree that in *some* animals there is sense-awareness, if there be little or nothing more; and that, though you are doubtful with regard to *all* animals, you are ready to listen to what may be said in justification of a belief which others seriously entertain. Of course these others should be no less ready to listen to what you may have to say in justification of your disbelief. But again I submit that for profitable discussion in all matters of belief there must be something to which both parties can assent, no matter how wide may be the margin of dissent.

On this understanding few will dissent from this proposition: The behaviour of some animals is such as to justify our imputing to them mental processes of some kind.

You may, however, still have qualms in provisionally accepting my newfangled extension of the use of the word 'imputation'. You may ask: Do you mean by imputation a special kind of inference? That, I should say, depends on what inference implies. It may imply reflective procedure with 'therefore' or 'because' to the fore, or at any rate lurking in the background. If so, I ask leave to include under imputation modes of reference far more simple and direct than this. But unfortunately it is much more difficult to express.

Let me put it in terms of what I have been led to believe. I do not believe that an infant in arms or Tony is capable of logical inference. But I do believe (though I am unable to prove) that, Baby, and Tony, and even Blackie, a week-old chick, do somehow impute to mother, or master, or another chick (as the case may be) somewhat of the nature of experience like their own. It is not, I think, a logical or reflective inference. So, for lack of a better form of words, I say that there is, as I believe, perceptive or unreflective imputation. I want somehow to name a kind of reference which I think is in being, let us say in Tony's mind.

I should distinguish, then, unreflective imputation on his part from reflective imputation on my part as a psychologist. Whether you here agree with me or not, can we not so far agree as to accept this proposition: There is in us, and probably in some animals, a form of reference from one mind to another? If so, will you not consent to my speaking of it as reference under imputation?

Before according your consent, you may ask: Does this imply that the mentality you impute to Baby or to Tony is not there unless you impute it to him? Because, you may say, if that be so, I cannot agree. Let me assure you, Gentle Reader, that it does not mean anything of the sort. Let us agree in the belief that

it *is* there in some animals and proceed to discuss its nature.

Still the question arises: Can one get at its nature save through reference to it in suchwise as to impute to Baby, or Tony, or Blackie, a nature in some measure like one's own—without putting oneself in his place? My belief is that one cannot do so. But you may believe that one can. You may say that there is, apart from any behaviour, or any physical influence, a direct disclosure of mind to mind, of Tony's mind to your mind, and that all you have to do is directly to apprehend that which is thus directly disclosed.

I grant that it may be so. But you do not mean, as I surmise, that you can get at Tony's, or Carlo's, or Ponto's mind wholly apart from any observation of his behaviour. You mean (do you not?) that you can also get at his mind in a much more direct way. Of this I am doubtful. But, since I do not deny that you may be able to do so, may we not agree that we do in some measure get at Ponto's mind through observing his behaviour, and leave direct apprehension, if such there be, an open question? In other words: May we not agree that there is at any rate *this* (imputation) whether there be *that* (direct apprehension) or not?

## § 5

If we search a little farther for a basis of agreement I shall venture to take it for granted that you, Gentle Reader, share with me the belief that there is a radical difference of some kind between what we commonly speak of as mind and matter. But such is the queer-ness of human nature that we may not agree as to the nature of this difference. So, for the present, we must be content to accept a radical difference in *some* sense of the word 'radical'. If, then, psychology deals with

mind and physics deals with matter (or some modern substitute for matter) there is at least a well-marked distinction between physics and psychology. This is not the place to discuss so large a topic. But, within our universe of discourse, and apart from sundry 'meta-physical speculations' into which we need not enter, I think we may say that, whereas physics has nothing to do with imputation, psychology has very much to do with imputation.

I suppose we may agree that physics is a branch of science. But we may not agree that psychology is a branch of science. You may say that psychology is a branch of philosophy. And then we should have to consider in what respects philosophy differs from science. We should have to ask: Is there some concept or ruling idea which distinguishes philosophical treatment from scientific treatment? Shall we provisionally agree that there is? If so, there is for philosophical discussion 'something more' than calls for scientific discussion. It may be, then, that some psychologists include this 'something more' (whatever it may be) while others exclude it.

I venture to say, not only that this may be so but that it is so. Hence difficulties arise. Can we, at any rate for the present, escape them? May we provisionally assign to psychology a double rôle, and regard it as in part scientific and in part philosophical? Then we may say: Psychology as a branch of philosophy includes more than does psychology as a branch of science. And this leaves it open to *me* to say: In what now follows I deal only with psychology as a branch of science.

There still remains the difficulty of characterizing in some way the part which *is* science. Here I take my cue from modern physics. In modern physics the initial stress—and some would say the final stress also—falls not only on that 'relativity' (in a technical sense)

of which we hear so much, but also on the *relatedness*, in a wider sense, of physical events. As in physics the relations are those of the 'material' kind, so in psychology the relations are those of the mental kind. Among these relations of a mental kind is that of reference, of which 'reference under imputation' is a specialized mode.

Thus, after some clearing of the ground, we come back to imputation, where, let us say, what goes on in my mind is in somewise related to what goes on in Tony's. This it is that we seek to interpret. But, as interpreters, it is *we* who impute; and as psychologists we do so reflectively with liberal doses of logical inference. Even that does not go far enough if we think the matter out seriously. It is I, or you, or another that imputes. Not only does the psychologist deal with individual minds, however typical they may be of some class of minds—human minds, ape minds, dog minds, rabbit minds, and so forth—but each psychologist sets forth on his career of imputation from *his own* mind, for in that mind only has he first-hand experience. Of all other minds he has only 'knowledge' through imputation. Such is my belief.

Do not suppose, Gentle Reader, that my aim is to show how boldly I can fly in the face of common sense. Common sense does not bother about imputation because the so-called 'plain man' takes it for granted as a matter of course. He may not use this word or some equivalent. But I think what he believes, translated into my jargon, comes to this. He says, in effect, that of course we 'impute' and are doing it all day long; that we act on our 'imputations'; that our actions work out satisfactorily; and that we are thus amply justified in believing (as all save some cranks *do* believe) that others—not only men and women but many animals—have minds very much like our own.

To each of these tenets in a common-sense creed I heartily subscribe; and I venture to assume that you also do so. But we are now digging deeper. We want to get down to the foundations on which this creed has been built.

I submit that these foundations are embedded in first-hand experience—as better men than I have urged again and again. And then it may be said that this first-hand experience can only be got at through introspection.

§ 6

How one thing leads on to another when once one starts digging! Here one comes down to introspection. And since, so far as I can see, it cannot be avoided if one takes things seriously, I presume, Gentle Reader, that you want to know 'what I think about it', though you may add: "I hope that this may not prove the opening wedge for erudition."

Let me cite from my own experience an illustration couched in language, I hope, not too erudite. Between 7.30 and 9.30 this morning much of this experience had reference to 'bedding out', bath, dressing, brush up, breakfast, and so forth. But so far as these matters of daily routine were concerned, there was very little introspection. Now, at 10 o'clock, I am, for purposes of illustration, thinking of the experience that then was mine. This reference *now* to what I was experiencing *then* is introspective, without prejudice to the moot question whether, strictly speaking, one can introspect what one *is* experiencing now, and not only what one *was* experiencing then if only half a moment ago. Leaving that on one side as savouring too much of erudition, there seems to be a distinction between mental processes for the most part unreflective, and mental processes

distinctively reflective. We may say, then, that first-hand experience may be either unreflective or reflective. Then I should define introspection as that mode of *reflective* procedure in which there is reference to one's own first-hand experience. The question then arises: Does Tony or Ponto introspect?

Bear in mind that I am taking for granted much imputation to others of like experience to mine, say during breakfast. I seek to concentrate attention on the first-hand experience that I reflectively contemplate in introspection. Now, waiving the question whether a science of psychology, worthy the name, could be based on any one man's introspection dealing only, however exhaustively, with his own experience, it is obvious that, on these terms, there could be no comparative psychology, and therefore no animal psychology. But if each one of us must start with his own experience in order to impute any experience to others—and we will assume that he does so—further questions arise as to how he proceeds in rendering some account of his own experience.

## § 7

A very general question has again and again been discussed for I know not how long: Should we explain any given set of events (comprising events which we assign to different levels) from above downwards, the lower in terms of the higher; or should we interpret them from below upwards, the higher in terms of the lower? I think one may say that many philosophers urge that we should explain from above downwards, and that most men of science contend that we should interpret from below upwards. Let us see what bearing these opposing principles of method have on the matters discussed in psychology.

In psychology we commonly speak of the events as 'processes'. And there is pretty wide agreement that there is a valid distinction between unreflective processes, as lower, and reflective processes, as higher, though it may be hard to draw a rigid line, or threshold, between them. The question then is: Shall we interpret reflective processes in terms of those which are unreflective; or shall we explain the lower unreflective processes in terms of the reflectively higher? Many introspective psychologists urge that the distinctive nature of psychology is such as to preclude the latter method of interpretation. We must therefore, they say, explain from above downwards. Let me however put the position, as I see it, in my own way.

As psychologists we start from the reflective level, for only at that level can we either explain or interpret anything in suchwise as to formulate conclusions either philosophical or scientific. We must, then, proceed from above downwards, starting from the higher level of reflection. But how, on this method of procedure, can we get at the unreflective? I suppose the common-sense reply would be: We strip off the garment of reflective process and disclose the underlying body of unreflective experience. Yes; that may be good enough for common sense: but is it quite good enough under the more delicate refinements of psychology? Are there not in modern physics refinements which call for some readjustment of common-sense belief? Here again I am desirous not to fly in the face of common sense, but to ask whether some revision of its opinion may not be called for in psychology no less than in physics.

Let me try to show what I mean by criticizing my own procedure awhile since. I said that from 7.30 to 9.30 this morning there was for the most part unreflective process in such daily routine as getting out



of bed, taking my customary cold bath, dressing, brushing up, and having breakfast; and that at 10 o'clock I was introspectively thinking about all this to the end of rendering some psychological account of the kind of experience I had in the early morning. Now, as the evening draws in, I am throwing a soupçon of doubt on all this if we pass to more delicate refinement of attitude. The stress is on more delicate refinement. What, then, do I now say? as perchance you may have said to yourself *sotto voce* as you read. I say that, though what I then sought to emphasize was good enough it was not *quite* good enough. How so? I am all the time from morning to night both unreflective and reflective. I may put on my clothes in the morning and take them off at night, but I cannot strip off my garment of reflection because it is part of me. I was not unreflective only from 7.30 to 9.30. Nor was I reflective only as I sat at my desk after breakfast. I have been, with varying emphasis, both reflective and unreflective all day long.

That, I fear, may seem trite enough, savouring little of refinement. So I must ask leave to be somewhat more technical. I am in part reflective and in part unreflective. Let me say that processes unreflective and reflective within my mind are members in partnership. And let me add that, in accordance with modern notions of organization, neither member in partnership is in all respects what it is, save in its relation to the other member in partnership. The principle here involved may be thus expressed. The whole is composed of parts; but the whole is more than the sum of its parts; for it includes also the relatedness of these parts in the fellowship of the mind.

Let me illustrate from social life. Men and women are in fellowship. And it may be said that each is what he or she is, so to speak absolutely; each is each,

and there is an end of it. If that be what is said it lacks psychological refinement. The more refined statement is: Each is each in some measure *relatively to the other*. Picturesquely stated, in any duet of social fellowship, man and wife for example, neither is soloist; if either plays that rôle there is no longer a duet. The part which each plays is related to that which the other is playing. And in virtue of this relatedness each player is what he is as duettist, not what he would be on another occasion as soloist.

To apply this principle in the context of introspection: unreflective and reflective processes play their duet within us. We can only get at the unreflective player through introspective reflection. But so long as he is duettist we cannot hear his voice as soloist. In other words, we cannot, as introspective psychologists, so divest ourselves of the garment of reflection as to know what the naked body of unreflective process verily is, save in the rough and ready fashion of crude common sense. No doubt this is good enough for practical purposes. But modern reflective thought, in psychology no less than in physics, calls for increasing refinement of method.

## CHAPTER III

### *Levels of Mentality*

#### § 1

The Gentle Reader may still jib at the uncouth word 'imputation', and at my specialized use of 'awareness' and 'percipience'. Let him, then, substitute for 'impute' some other word of his own choosing. But let it signify what I mean by the word. Colonel Hutchinson observed certain behaviour in his retriever; he imputed deliberation. His son imputed a lower level of mentality, something less than reflective procedure, but still perceptive procedure. Both imputed visual percipience. But neither could observe even this percipience.

On what, then, is this imputation of percipience founded? I reply: It is founded in the first-hand experience of the observer.

Do you hesitate to believe that your dog is percipient in many ways—in seeing, touching, tasting, smelling and so on? I guess not. But you cannot, in strictness, observe his percipience. You impute it to him—at any rate I impute it, say, to Tony. And I do so in an attitude of confident belief. But when I myself am percipient that is not belief on my part. For me at the time-being it admits of no doubt. It is for me, so to speak, bed-rock of experience—that bed-rock of experience to which Descartes sought to get down, but clothed it in a reflective garment of self.

As I understand him, Descartes did not impute this conceptual garment of self to any animal. But most

of us impute, if not self-consciousness, a great deal more than percipience to the higher animals.

Suppose that you and I are watching an ape that wants to get a banana which we have placed beyond his reach. Perhaps we want to see whether he will use a stick in order to get it. You and I do not want to get it. We both impute this want, or urge, to him and feel amply justified in doing so. All his behaviour is consonant with this belief. Still more firmly do we believe that he sees the banana as we do. We all three share visual percipience. And yet we share it only under belief on your part and mine. Each has first-hand experience all his own. For each it is what it is independently of any belief. This first-hand experience, whatever it may be, cannot be shared with anyone else. We watch the behaviour of the ape. But we cannot have first-hand experience of his awareness in behaving. If your muscles are twitching to 'help him in his task' (mine do), your own twitch-awareness is probably pretty different from his first-hand awareness.

I need not further labour the point. You may deem it trivial. I regard the distinction between first-hand experience and imputed experience as fundamental.

## § 2

I have been led to distinguish three levels of mentality—percipient, perceptive, and reflective. You may ask: Why three? Why not, say, thirty? And why levels? Are there not an unbroken series of ascending steps?

I have not a word to say in defence of the word 'level', if it is taken literally; I merely ask leave to use it. A series of ascending steps—thirty or thrice thirty—Yes. So many percipient steps; so many perceptive steps; a great number of reflective steps. But with, so to speak, a landing-stage at the 'level' of perception; another

landing-stage at the 'level' of reflection. When I say that mentality reaches the 'level' of perception I mean that it has got beyond that landing-stage; so too with the 'level' of reflection. Strictly one should say 'above this level' in each case.

Even so the trouble is that any mechanical analogy plays one false. Suppose that a boy of seven years has ascended some steps above the level of reflection; he is still ascending the perceptive steps; nay more, still ascending the steps to fuller and richer percipience. He is advancing upward along all three flights of steps at the same time.

Now my belief is that some animals are percipient only; some are not percipient only but are perceptive also; and some, perhaps only a few, are not perceptive and percipient only but incipiently reflective also.

Let me now supplement this by a further statement of my belief, fully realizing that you may not accept it as part of your belief. I believe that those animals, if such there be—and at any rate those human folk—who, as adults, are reflective, were, at an earlier stage of life, perceptive and percipient only. Nay more. I believe that all animals (and human folk) at a yet earlier stage of life—perhaps at a very early embryonic stage of bodily life—were percipient only.

That, you may well say, is a large order—a draft on your belief which you are not prepared to honour. It introduces the concept of development and a natural sequence in mental development, namely, first percipience, next perception, and then, perchance, reflection. This gives, in brief, the historical order of the levels of mentality which I feel justified in imputing in the situations which arise at the successive stages in any individual mind.

But more than this follows. I believe that this is not only the order of development in the history of

any reflective mind, but also the order of evolutionary genesis in the life-history of mind on our earth.

This takes us far afield. Should we not start at home? Must we not start at home if it is only through imputation that we can go forth afield? Must we not find percipience within our own experience in order that we may impute it to any other mind?

It seems, then, that our aim should be to distinguish the three levels of mentality which are inseparably co-present in our own experience. And here the Gentle Reader may say: You ask us to consent to your use of these three words—percipient, perceptive, and reflective. Before I do so I wish more clearly to understand, at least in preliminary outline, what you mean by them. I must feel satisfied that, for you at any rate, they severally denote something in each case distinguishable.

That is reasonable enough.

Awhile since I listened in to a rendering of the Kreutzer sonata. As a reflective being, at that level of mentality, a good deal 'passed through my mind'. Of course I ought to have been so absorbed in the music as to leave no room for aught else. But I was not what I ought to have been. You must take me as I was.

With the opening bars there came:

And I know not if, save in this, such gift be allowed to man  
That out of three sounds he make not a fourth sound but a star.

Why 'star'? Why not 'chord'? Poetry. Do animals, if they cannot make, at any rate take sounds in their 'chordiness'? This 'wireless' is rather wonderful. How much did that nice girl the other day understand from such lame answer as I could give to her question about the transformation of wireless waves into sound-waves on the ear? Strange how I feel myself sitting in the drawing-room of my boyhood's home; my mother at the piano; my father with his Amati. How clearly I

see it all. My father's familiar twitch of the mouth, the full sweep of his bow. I wish I could see the present performer's bowing. By the way, do I visualize *him*? If so, where? Ah! Now that fine passage is just coming. I already 'fore-hear' it in expectation. And so on.

I try to set down what was there—did so in fact within the next half-hour. I know well that as thus set down it is too crisp and clear-cut. But it will serve my present purpose. I now seek to submit it to analysis.

There was some musical appreciation. There was reference to myself as a boy. There were thoughts which came to mind. All this, and the like, is at the level of reflection, and is got at through introspection.

Now suppose that in reflective analysis I cease to pay attention to all this. Much still remains; acquaintance through sight with the room in which I am sitting; someone entering the room through the door out there; the position of the hands of the clock; expectation of its striking in a moment; the sound of the violin perhaps vaguely located as at least distant in source; the smell of tobacco from my companion's pipe. All this and the like is at the level of perception.

Under further analysis, while still attending to all this, I strip off (1) all location in space, and (2) all reference in time—all remembrance; all expectation. I leave only the bare now of the passing moment. I leave percipience only. Then there are just sounds on the ear; sights to the eye; scent in the nostrils; warmth or cold to the skin; touches or pressures, not even located here or there; just the rude foundation-stones of crude sensory experience, organized no doubt, but, so to speak, moulded to the organization of my body; attuned to sensory stimulation. That, and the like, is what I mean by percipience; just what would remain if I could get rid of all perception.

I have proceeded from above downwards, digging down analytically from the top-level of reflective mentality to the bottom level in percipience. But I can build up synthetically from percipience to reflection. Even so I do this reflectively. And, under reflective imputation, I can ask: Do some animals get no farther than percipience? Are many animals perceptive also; locating objects and expecting things to happen? Do some animals reach the reflective level, though they may not get more than a step or two beyond the reflective 'landing-stage'? Have those who may do so—some apes for example—passed in the course of their mind-history through an earlier perceptive period, and a yet earlier phase of their development when they were percipient only?

### § 3

In what I have said on percipience, perception, and reflection, as a preliminary attempt to get at the characterizing features by which they may be distinguished, I took for granted behaviour and the awareness in behaving which accompanies its progress. Such abstraction is part of the method of reflective procedure. By abstraction I mean the concentration of attention on what matters for our thought at some time-being. As I watched Tony with a stick at the railings my attention was fixed now on what he actually did and now on the level of mentality which I felt justified in imputing to him while he did it. In all experimental work, in our field of inquiry, there is such fluctuation of attention between what is observed and what is imputed. Each in turn is reflectively regarded in abstraction from the other which for the time-being is taken for granted—let us say, first, the end to be attained through behaviour, and *then* the behaviour by means of which the end is to be attained.



Let us consent to speak of the 'outcome' of behaviour as that which can be observed, say the getting of the banana by a chimpanzee. Then what we impute to the ape is an end in view, but here one must add 'to the best of my belief'. One may impute more or less. Some may say: The more we impute the better. Others may say: We should not impute more if less will suffice. May I suggest an expansion of each claim? Then I say: The more we impute the better, if our aim be that of a man of letters, namely, to tell a dramatic story enriched by poetic imagination. But I say: We should not impute more if less will suffice, when our aim is to interpret the animal mind in terms of evolution subject to the method of scientific procedure. Since this is my aim, I am among those who say: If the less of perception, for example, suffices for the interpretation of the behaviour we observe there is no call for imputing the more of reflective procedure (p. 22).

We may take the behaviour of Tony at the gate, at the wall, at the railings, as exemplifying in sufficient detail what may be perceptive procedure only and no more than this. But if I say that I believe that it is so, this belief is based on a series of occasions under close observation. The behaviour of Colonel Hutchinson's retriever may have been reflective. But his belief that it was so was based on a single and unique occasion. Never before, he said, had she been known to ruffle a feather.

The telling feature of Professor Köhler's careful observations from which he draws conclusions with respect to the mentality of the apes at the Teneriffe station, is that they deal with a series of occasions. The chimpanzees were not taught or trained to do this or that. They learnt to do this or that 'on their own'. He gives full details, and expresses his opinion that we are justified in imputing to them 'insight' (*Einsicht*).

Let me assume that such insight betokens mental procedure in some measure reflective.

Note that I speak of mental *procedure*, as that which is imputed, and of bodily *behaviour*, as that which is observed. I do not speak of mental behaviour. Others, no doubt, do so; but I do not. On this understanding I ask: What kind of behaviour justifies, in my belief, imputation of reflective procedure as more than perceptive procedure? It is behaviour on a series of occasions. I do not propose here to enter into detail. Reflective procedure (on our part) under the method of 'supposal', will bring out what, as I think, should stand out. Suppose that some ape wants to get a banana—which Herr Köhler well calls 'the objective'. If it is within reach—all right. If it is at a little distance outside the bars of his cage, he uses a crook-ended stick to pull it in. If it is suspended to the roof, he may have learnt to stack two or three boxes so as to reach it. But suppose that it is well beyond reach with his stick, and still a little beyond his reach when he stands on the boxes and perhaps jumps. What then? He can get it neither way. But *we* see that he can get it if he *combines the two ways in a fore-plan* (p. 7). Suppose, then, that on failure to reach the objective from the stack of boxes, he climbs down, fetches the stick, climbs up again, and gets the banana. Does that betoken some measure of reflective procedure and a fore-plan on his part? I am of opinion that it does.

Thanks to the admirable work of Yerkes, Köhler and others, I feel justified in imputing to the higher apes more than perceptive procedure. Less than some measure of reflective procedure does not seem to suffice. To what measure an ape can attain it is as yet hard to say. Professor Yerkes has suggested that mental stature which is attained by a child of some three years.

What, then, may one impute? The formation under combination of a new plan not yet carried into execution; on success a fore-plan of action under like circumstances; some retrospection with reference to previous doings with success; probably some realization that it was *he* who did this or that before, and he who can do it again. Perhaps more; methinks not less.

It may, however, be reminded that I myself said many years ago [*I.C.P.* 2nd ed., 1903, p. 381], "that the evidence . . . is not sufficient to justify the hypothesis that any animals have reached that stage of mental evolution at which they are even incipiently rational". I now substitute the word 'reflective' for the word 'rational'. But, you may ask, is this more than a verbal distinction?

I am nowise ashamed of a change of opinion, after nearly thirty years, in the light of fresh evidence. May I not leave it at that? If further comment be in place, let me just add this. It is sometimes said of folk of my kidney: They *want* to credit the animal mind with as little as possible—to reduce animals to the merest automata. That is not so. The 'want' imputed to us is a wholly erroneous imputation. What we want to do is to interpret the animal mind in accordance with the best available evidence gotten through observation of behaviour. It is part of 'the queerness of human nature' that some folk persist in imputing to those with whom they are unable to agree lamentable 'obsession' by this or that 'false dogma'.

#### § 4

The question before us is: What may we impute to the animal? One sees him behave in some describable way. One sees that his behaviour has some more or less definite outcome which one commonly speaks of

as its 'end'—opening the gate, getting the banana, and so forth. The behaviour itself, as an orderly sequence of motor acts, may be relatively simple or very complex. The 'end', or outcome, is more and more definite as the behaviour is more and more organized as a 'means to that end'. But here the words 'end' and 'means' are general names for what *we observe* in individual instances on these occasions or those. Our question is: What may we *impute* to the animal on such and such an occasion?

Now one *may* impute much, or one may impute little, as one likes. M. Maeterlinck imputes far more to the Bee or the White Ant than I do. But he writes as dramatist; I write as mere dull man of science. And here the physicist, as representative man of science, may perhaps intervene. No science, he may say, can be based upon what you call 'imputation'. You just put in what you like, and then take out what you please. I have some sympathy with his attitude. But I ask him: When you leave your laboratory, and when, as you put your latch-key in the home-door, Carlo 'barks his welcome', do you believe that he has a mind of sorts; if so, do you act on this belief; do you in some fashion organize the set of beliefs you entertain with reference to his mind, your cat's mind, those of the cows and pony in the paddock, of your boy's pet rabbits, of the birds in the garden, and so on? Do you assert that generalizations in respect of a set of beliefs with reference to the animal mind cannot in any valid sense be called scientific? Let us not quarrel. Let us, rather, realize how serious is the difficulty that faces those who seek to ascertain what 'really is' in any other mind than their own. It is the difficulty inherent in imputation.

And let us realize this also: that it is far duller to interpret in terms of the less than it is to expatiate

in terms of the more. M. Maeterlinck's dramatic rendering of the life of the bee is much easier for most Gentle Readers to grasp than any that I could give; and it carries a stronger appeal to most of us who, after all, are dramatists at heart and by early education.

Let me now come down to details, and give an oft-quoted example of what the naturalist speaks of as instinctive behaviour, which may be mainly at the percipient level of mind in evolutionary regard.

The *Yucca* [*A.B.* 82] is a genus of American Liliaceous plants, with large pale sweet-scented flowers; and these are dependent for fertilization on the instinctive behaviour of a small straw-coloured moth of the genus *Pronuba*. Just when the *Yucca* plant blossoms in the summer, the moths emerge from their pupa cases. They mate; and the female then flies to a flower, collects a pellet of pollen from the anthers, proceeds to another flower, pierces the pistil with her sharp ovipositor, lays her eggs among the ovules, and finally, darting to the stigma, stuffs the pollen-pellet into its funnel-shaped end. If the flower be not thus fertilized the ovules do not develop; and if the ovules do not develop the grubs which are hatched from the moth's eggs would die of starvation. There are enough ovules to supply food to the grubs and leave a balance to continue the race of the *Yuccas*.

Here is what I am wont to call a plain tale of behaviour on the part of the female *Pronuba*—still, so far as I know, substantially correct. It tells what she does. Not a word carries mental import unless you supply it (as you probably do) under imputation. I guess M. Maeterlinck might supply a good deal. Suppose you ask: Does the moth find the flower by sight or by scent; and does the male moth find his mate by scent or by

sight? I do not know enough about the *Pronuba* to say. It has, however, been suggested as highly probable [*A.B.* 83] that, in certain moths, some odour emitted by the female is the attractive stimulus, affecting sense-organs situated on the antennæ of the male. To females confined in an opaque vessel over the mouth of which gauze was tied, the males came in numbers and settled on the gauze; but when a clear glass vessel was inverted, and sand was packed round the mouth, so as to prevent the escape of air from the interior, no males came, though the imprisoned females were clearly visible.

Here at any rate, you may say, there is at least percipience in the moth. Yes; and that is just the point; *but under imputation*. Apart from imputation there is only 'response under stimulation'. I supply under imputation (1) all the modes of percipience of which the moth's sense-organs permit; (2) all the modes of awareness in behaving which accompany, or are co-related with, the observable behaviour. And I believe that of both there is *much*, very subtly organized. Biologically organized? Yes. But biologically only? Emphatically, No. Mentally organized also, at the level of percipience.

I implore you, Gentle Reader, and would use a stronger word, could I find one—I implore you to do your utmost to grasp what this means for the present writer. It means that at the level of percipience the mind, say of *Pronuba*, is extraordinarily richly organized, or integrated, as one whole. This is so in the percipience which is co-related with all instinctive behaviour.

It is easier to put oneself in the place of a young bird than of a moth. Let us try to put ourselves in the place of a little Merganser not more than a fortnight old in a situation which the eighth Duke of Argyll

describes [*H.I.* 204]. He was in a boat and gave chase to a dun-diver with her brood of ducklings. One of the brood made for the shore but reached it when the boat was still some twenty yards off. "Long drought had left a broad margin of small flat stones and mud between the water and the usual bank. I saw the little bird run up a couple of yards from the water and then suddenly disappear. Knowing what was likely to be enacted, I kept my eye fixed on the spot, and when the boat was run upon the beach, I proceeded to find and pick up the chick. But on reaching the place of disappearance, no sign of the young Merganser was to be seen. The closest scrutiny, with the certain knowledge that it was there, failed to enable me to detect it. Proceeding cautiously forwards, I soon became convinced that I had already over-shot the mark; and on turning round, it was only to see the bird rise like an apparition from the stones, and dashing past the stranded boat, regain the lake—where, having recovered its wind, it instantly dived and disappeared."

We may here fairly impute 'fear' and that which one may speak of as a 'felt urge' to escape. But we need not impute any 'expectation' of the outcome of its behaviour. In other words, the *outcome*—eluding an observant eye—need not imply an *end in view*—to elude 'an observant eye'. What I, for one, do impute is (apart from awareness in behaving in an orderly sequence of motor acts) many modes of percipience. And all the forms of behaviour-awareness, in diving, swimming, running, crouching; with all the modes of percipience, visual, auditory, tactual, and other, enter into integrated synthesis to constitute the bird's first-hand experience at the percipient level.

The little Merganser may have escaped in this way on some earlier occasion. But the *Pronuba*, whose behaviour is in its fashion not less elaborate, does what

she does only once in her life-time. There is not, in her case, a series of occasions; there is just one occasion. The individual moth cannot have learnt how to do the trick. She cannot (as perhaps does the ape) look back retrospectively, on a previous occasion on which *she* did it—for there *was* no previous occasion. Has she 'expectation' (as Tony at the gate probably has) of the next step in her behaviour? Not, it seems, as Tony probably has. For his 'expectation' is based on his experience of the next step on prior occasions. In the course of the Pronuba's experience there has been no prior occasion. She is, it would seem, shut up in the passing 'now' of percipience and of awareness of behaving.

Here you may not agree. We must reckon, you may say, with 'racial experience' and 'ancestral memory'. No doubt we shall have to do so in some wise. But not now. Just now I seek only agreement in this: that accompanying so-called instinctive behaviour there is at least percipience and awareness in full measure and highly organized in some way.

## § 5

I hope that you may provisionally consent to the use of the words 'percipient', 'perceptive', and 'reflective', which *may* name stages in mental evolution—the stage at which Pronuba stands, that which Tony had reached, that to which Chica the chimpanzee may have risen. Of course you may believe that *your* faithful dog Pluto or Fido is more than perceptive; or you may harbour doubts as to the reflective status of any animal, even the most cunning of apes; or you may feel sure that Pronuba is not percipient only but in some way perceptive at the least. We must not expect as yet (if ever) to reach anything like full agreement.



At any rate I assume that you and I are both reflective folk and that, since the greater includes the less, we are also perceptive and percipient. As reflective we contemplate our own life and conduct. I am on holiday, let us say. Yesterday I went over to see Rochester Cathedral; to-morrow I propose to visit Canterbury. In retrospect I *was* there in Rochester; in prospect I *shall be* elsewhere—in Canterbury (if all goes well). The threefold emphasis is on I,—was or will be,—there; more generally on self, time, and place. All three, self, time and place, are 'in mind' now. That is distinctively a reflective attitude. Reduce it to simpler expression. I lunched yesterday at home; I shall lunch to-morrow with a friend; I think of this now. If, on receipt of a telephone message, I say: So I shall lunch at home to-morrow at one o'clock instead of one-thirty; it makes no difference in principle; still self, time and place are now in mind.

But suppose that you and I watch the behaviour of an infant whose span of life since birth is reckoned in as many days as I can count years. Rochester and Canterbury or their equivalents are of course not in the picture. But we may take his bottle-occasions as perceptively equivalent to my lunch-occasions. I believe that his behaviour justifies my imputing to him expectation (in some sense) of the further development of the bottle-situation, and place-reference to where it is as the nurse brings it along. But has he retrospective reference to some previous occasion on which she did so? Does he think of himself as then there? If I believed that he does so I should impute to him reflective procedure. Since I do not, I impute to him no more than perceptive procedure. On these terms I believe all that happens in infancy may be psychologically interpreted. On these terms I believe all that happened in Tony's life may be interpreted.

Here perhaps you cannot agree. You may raise the question: Have, then, the infant and the dog no memory? And if I reply: They have remembrance, which may be perceptive, but not true memory, which is always reflective, you may accuse me of 'erudite' word-splitting. Let me then tell you what I mean. I mean that in my opinion the behaviour of infant or dog is such as to justify imputing to him 'expectation' or fore-experience of what is coming on such and such an occasion, based on the experience he has gained on prior occasions in like circumstances. And I venture to hope that, on this understanding, we do not disagree in imputing *at least* such 'expectation' to animals that reach the level of perception.

But what about Pronuba? Do I impute to her *no* perceptive procedure on *any* occasion throughout her life? I do not go as far as that, though others do so. I take for the sake of illustration a special train of behaviour on her part—an enchained sequence of motor acts of which the outcome is the fertilization of the Yucca and the nourishment of her young.

Let me add a more up-to-date instance of the queerness of a moth's nature. The male (*Lissopimpla semipunctata*) visits a species of orchid, apparently attracted by the smell. He backs into the flower and behaves as though it was a female of his own species. Mrs. Coleman, who reports the occurrence (confirmed by other observers), detected the sperms of the insect on the flower, which, she says, resembles the female moth 'to some extent'. The disc of the flower adheres to the last segment of the insect and the polinia are so placed as to touch the stigma of the flower next visited.<sup>1</sup>

To go back to Pronuba. Her behaviour is observed once only in the course of moth life—broadly speaking 'on one occasion'. In a dramatized story of her procedure

<sup>1</sup> *Trans. Ent. Soc.*, 1929, p. 533.

it may perhaps be said that no doubt in some way she realizes that fertilization of the Yucca and nourishment of her young will be the outcome of her act; that in some clairvoyant fashion she pictures herself as watching the future progress of matters in both respects. If so, I should say that (apart from supposed clairvoyant prevision) she is a very highly reflective person. I do not believe that she is anything of the sort. But I am pretty sure that M. Maeterlinck could make her the heroine of a fascinating romance which I should fully enjoy—when I was off scientific duty. Does not our Mr. Crothers tell us that, in like moments of relaxation, he has “known some very conscientious students of literature who, when off duty, have found time to enjoy poetry ”?

Why then, when I am on duty, do I not say roundly that I impute to the moth no perception of any sort on any occasion? Because *that* would go beyond the evidence. A Pronuba may do many things incidental to insect life, not once only but half a dozen times or scores of times, and may learn to do some of them better—much like Tony at the gate. Perhaps the moth Pronuba does not show much evidence of this. But in the case of some insects there is, I think, good evidence that they do ‘profit by experience’. If they learn to do things better and differently to meet new circumstances, they presumably behave with ‘expectation’ on these later occasions, based on the experience they have gained on previous occasions. In these matters they are no longer percipient only but also in some measure perceptive. None the less I believe that they, and all animals, are *on each first occasion* percipient only with awareness in behaving under some urge (food-hunger or sex-hunger, for example) on *that* occasion ‘instinctively’.

## § 6

I have taken as an illustrative example of what many naturalists speak of as instinctive behaviour, that which a *Pronuba* moth has been observed to do. It is pretty complex and runs its course to an outcome which the observer can foresee. What is done is done only once in the lifetime of the moth. But there are thousands of examples of instinctive behaviour in which what is done is done again and again. Bees build waxen cells for the storage of honey on many occasions. In an ants' nest, or in a termitary, much oft-repeated behaviour is in evidence. In so far as instinctive—note this qualification—in so far as instinctive, the behaviour is on all occasions like that which may be observed on the first occasion. One may speak of the performance as *da capo*.

Let us assume that the observations of those naturalists who assure us that this is so are trustworthy. Then let us hear what one of them—Herr Bethe—long ago said. He is drawing an inference as to the mind (or lack of mind) of an animal in so far as the behaviour is instinctive. "An animal," he says, "that is able to do the same things the first day of its existence which it can do at the end of its life, that learns nothing, that always reacts in the same way upon the same stimulus, possesses no consciousness" [*M.C.* 132]. That means, I take it, that Bethe did not feel justified in imputing to such an animal mind of any sort.

Here I cannot agree. I impute to such an animal mind of a sort; but only of the percipient sort, with *da capo* percipience and *da capo* awareness in behaving. You probably do not yet realize how much this means to me—how rich in its kind is the percipience I impute, how rich the awareness in behaving, how highly integrated, in technical phrase, are the percipience and

awareness in their subtle combination—no whit less integrated than is the bodily behaviour under stimulation.

But let that pass. Our representative naturalist says that an animal, in so far as it behaves instinctively, 'learns nothing'. He then, by implication, takes learning something in the course of individual life as the criterion of consciousness. Here I am prepared to agree in the sense intended. I think that what most of us mean by conscious procedure is that which is at least perceptive—that which betokens 'expectation' based on what has been learnt on prior occasions. Why not consent to accept this common usage? Then if percipient mind there be, it is something less than or lower than *conscious* mind. May we not consent to name it *sub-conscious* mind? This will then mean 'mind at the percipient level of mental development', and nothing more than this; no so-called 'unconscious wishes' if a wish implies prospective reference as it surely does for most of us.

Pass now to reflective procedure. I believe—though many may not here agree—that in all reflective procedure there is reference to self. There is something unspoken, but none the less in the field of reflection, which in our speech takes some form as: I did it, am doing it, am about to do it. In all reflection there is, I believe, some reference to self (and to other selves) on the mental horizon. Why not, then (I ask), give verbal recognition to this reflective notion of self? Then we have (1) sub-conscious percipience; (2) conscious perception; and (3) reflective procedure as self-conscious.

Psychology deals with all three, because in all three there are mental relations.

## § 7

It is difficult to adduce convincing evidence that Chica, the chimpanzee, or another ape, is incipiently self-conscious—that the mentality of some apes has *this* mark of its reflective level along with other distinctive marks.

We are, however, just now concerned with that first-hand experience which as adult human folk each one of us 'has'. We get at it *reflectively* through introspection; and yet we may believe that very much of our first-hand experience is perceptive and percipient.

The position is this. I am reflective; but I am not only reflective, I am perceptive also; and, yet deeper down, I am percipient. All imputation of percipience to another mind is rooted in my own first-hand experience as myself percipient. But only in my reflective capacity do I bother about such a question as whether I am percipient or not. I just take it for granted as a matter of course. If you ask me to justify at the bar of reflection this matter-of-course belief, I tell you that I can introspectively bring this percipience within the field of my reflective 'vision'. I can, if I may so put it, view my percipience with the eye of reflection. But then the question arises: Can I be quite sure that in this way I get at percipience as it is when it is *not* under the eye of reflection?

I hear, 'on my mind's ear', a musical phrase—say a recognizable bit of Handel's *Largo*. It affords an example of auditory percipience, overlaid by perception, as this is further overlaid by reflection. I fix my attention on some one chord, still in its reflective *Largo* setting. Is it what it is independently of precedent and succeeding chords? For me it is not. It is qualified by its 'music relations' in the *Largo*.

I get rid of that. I ask someone to give me just a chord, and I direct my attention to one note in that chord. Is it what it is independently of the other notes in the chord? For me it is not. It is what it is, within my experience, in its relation to these other notes.

I now ask someone to play this one note by itself on the violin. I can distinguish a ground-tone and certain partials or overtones which give to the note its violin timbre. When I actually hear it—when I am percipient—is the ground-tone then and there what it is independently of these partials? For me it is then and there what it is *in its relation* to these partials.

No doubt by appropriate means I can get a 'pure' ground-tone pretty free of partials, save perhaps in octave. If so, then and there I have a different mode of auditory percipience. But even so it is what it is in relation to all other modes of percipience within my first-hand experience at the time being. Even so one cannot get rid of relatedness.

I thus strike that chord of relatedness which I think is becoming increasingly dominant in modern discussion. And I ask this general question: If we start with what is given in some synthetic whole of relatedness, and disentangle under analysis its constituent parts, can we say that these constituents *out of combination* are just the same as they are *in combination within that whole*?

What we have specially to consider as that which affords the basis of all imputation is the synthetic unity in relatedness of one's own first-hand experience. In that experience reflective, perceptive, and percipient factors are in subtle combination as constituent parts within the whole. We seek through reflective analysis to get down to unreflective percipience. We can do so with large measure of success. And yet, if our aim

is to be thorough, we must still ask: Is not the percipience we reach through reflective analysis in some measure coloured (so to speak) by the reflection which makes us what we are as adult human folk?



## CHAPTER IV

### *Some Gossip*

#### § 1

Mr. Crothers, to whom I made reference in the Preface, reminds us that Fielding, leaving Sophy Weston abed and in sleepless distress, turned aside to gossip about the Universe and the queerness of human nature. The digression, he says, might be quite irrelevant; but that, he adds, is what the Gentle Reader likes.

Without endorsing, at any rate in such a context as ours, this penchant for irrelevance which Mr. Crothers regards as part of the queerness of human nature, I venture to hope that *my* Gentle Reader will not have deemed irrelevant some consideration in the last chapter of first-hand human experience since it is the basis of all imputation. And since in the animals with which we are concerned a body is in some way very intimately connected with the mind; since, too, my belief is that body and mind are implicated in an evolutionary process common to both; I trust that he will not deem irrelevant what follows in this chapter.

Biologists are wont to speak of the organism and its environment. This environment is the part of the world in which the organism lives. And we may assume that the world in which Tony lives is that in which we also live. He and we are in physical relations to this world through the influence received by our bodily sense-organs, and in mental relations to it under that which I have spoken of as reference, percipient and perceptive.

We take, then, some 'situation', such as Tony at the gate, and we ask: When we observe such and such behaviour, what are Tony's relations physical and mental to his environment?

Here we take Tony to be a living organism. But here I surmise that the Gentle Reader may say: I used to know pretty well what was meant by the words 'organism' and 'organic'. Nowadays, however, I am somewhat perplexed. I find the word 'organism' so used as to be applicable not only to living creatures but to atoms and molecules; and I hear tell of an 'organic theory' which deals largely with that which I was taught to regard as inorganic. Does this fall within your 'gossip'? If so, I should like to know what you have to say on the topic.

## § 2

A good deal of discussion has followed Professor Whitehead's extension of the use of the word 'organism' so as to include molecules and atoms as well as animals and plants. Many are not prepared to consent to this usage, and you, Gentle Reader, may be among them. If I ask: Why? you may reply: Because it goes far to annul the distinction between the living and the not-living.

Let me assure you that I, who willingly consent to this usage, believe that there is a well-marked distinction between a living organism and a not-living molecule or atom. All three have quite distinctive characters. And if you believe that the distinction between the living and the not-living is of greater consequence for human thought than that between the molecule and the atom, so, too, do I. Thus far we are in agreement. The question then is: Making due allowance for these distinctive characters, are there some characters common

to all those 'entities' which some of us now consent to call organisms because they all have these common characters? I believe that there are. What then (you will ask) characterizes all organisms in this new sense and any organism that one may select?

Any organism is a whole with constituent parts; and yet it is a whole which is more than the sum of its parts. Furthermore, each constituent part is more than only a constituent. It has, as *part*, a distinctive character in relation to the other parts and to the whole.

Now if you think only in terms of structure you may not make much sense of this; you may fail to see what is meant by 'more than'. Think, I pray you, in terms of function. Then the word 'part' emphasizes the 'part which is played' by some constituent in the working of the organism as a whole. Is it not just here that, for you, the emphasis falls when you think of a living organism? Do you not think not only of the organs of a living animal but also, and chiefly, of how they work together so harmoniously as to contribute to the maintenance of the whole of which they are more than constituent parts since they are co-operant partners? Do you not say: *This* is what characterizes the *life* of the animal as an organism?

Turn now to the molecule. Its constituent parts, or 'organs', are atoms—say one of oxygen and two of hydrogen in the molecule of water. But each atom plays its part, or has its 'function', in the working of the molecule as a whole. Here, too, the atoms work together so harmoniously as to contribute to the maintenance of the whole of which they are more than constituent parts since they are co-operant partners. And so some of us now say: *This* is what characterizes the 'molecularity' of this not-living organism.

Similarly within the atom 'electrical charges' as parts play their parts. Here, too, the whole is more than

the sum of its parts. And so some of us now say: This is what characterizes the 'atomicity' of this not-living organism.

Alike in the living and in the not-living organism not only is the whole more than the sum of its several parts, but each part is more than it is 'in itself'—that is, 'apart from' its relations within the whole. It need scarcely be added that this stress on the 'more than' implies no denial of the 'less than'—that is, what the constituent is 'in itself'. It opens up the questions: In what *respects* more than, and in what *degree* more than?

What, then, some of us believe to be common to all organisms, living and not-living, throughout the length and breadth of nature (but all within nature) is this part-whole relationship. What distinguishes this or that type of organism—atom, molecule, or animal—is the *kind* of relationship of which there is evidence. And these three stand in a natural order. The living stands highest and is latest in evolutionary genesis. The atom stands lowest and, of these three, is earliest.

Now it is especially noteworthy that within the living organism there are molecules and atoms as parts which play their parts within the whole. In general terms any higher organism, as seen by the reflective eye of distinguishing analysis, opens up a long suite of lower or subordinate organisms, reaching right down to the atom and below that to the electric charges which play their several parts therein. All, however, from top to bottom, exemplify the part-whole relationship which characterizes every organism.

This extended and comprehensive use of the word 'organism' carries with it a no less extended use of the word 'organization'. Thus we may now speak of the organization of an atom, a molecule, a crystal, and so on. The higher the type of organism the higher is the type of organization. Hence vital organization,

with those specialized modes of physiological relationship which fall under the heading of 'regulation', is far higher than that which is found in any not-living organism.

The kind of relations with which I have been dealing may now be termed 'organic relations', and the general principle of interpretation, *the organic principle*.

### § 3

Thus far I have spoken of organisms, and of organic transactions within organisms. I turn now to what may be called mere things. Take, for example, a pebble of sandstone. Under distinguishing analysis one may discern fragmentary bits of organized crystals of quartz, aggregated in a mass. In each of these there are molecular organisms; and in each molecule there are its constituent atoms. But the pebble *en masse* is just a mere thing. The crystalline fragments within it are in mechanical relations. It is in mechanical relations to other such things. And this, or any other such thing, is *no more than* the sum of its constituent items in their summated mechanical relations.

I seek thus to distinguish, in brief and summary fashion, mass-aggregates and their mechanical relations, from organisms in which there are also organic relations. Galileo and Newton and the elder astronomers were concerned chiefly with the former. The distinction is technical and there is a good deal more to be said about it. So much, or so little, must here suffice.

We must now extend the range of the organic principle so as to comprise the organic relations of the organism to its environment. It not only acts and reacts as does any mere thing in mechanical relations to other things in the environment. To these things it plays its part in organic relations also. And the environment plays a reciprocal part in its organic relations

to the organism. Though no wise restricted to the living, this calls for special emphasis on the part of the biologist when he discusses 'fitness' or adaptation. Here, as Dr. L. J. Henderson says: "The fitness of the environment is one part of a reciprocal relationship of which the fitness of the organism is the other part." On the organic principle this does not mean only that there is mechanical 'action and reaction' between one and the other. This there is; but if there are organic relations, there is more than this. In other words, a merely mechanical interpretation of biological adaptation does not suffice to enable us to render a full account of the observable facts.

When we pass from biological relations to the environment to psychological relations; when we pass to that kind of relationship which is not bodily only but is mental also; a mechanical interpretation—if indeed this collocation of words has here any meaning—is quite hopelessly inadequate.

That, Gentle Reader, is the position to which I seek to lead up. In our context (that of mental relatedness) all interpretation should, as I believe, be couched in terms of the organic principle. I have tried, therefore, to show in brief outline what I mean by the organic principle. I may have said enough to enable you at least to see 'the pattern of my thought'. That is what you want to get at. I shall, however, have grievously failed if it should seem that the organic principle is in evidence only at some high level—perhaps only the highest level—of organization. Nay, rather it is a principle of interpretation applicable at all levels in so far as that nature which includes life and mind is one organic whole.

#### § 4

My aim in interpolating this chapter of gossip about the universe is to answer a general question which I

think the Gentle Reader is pretty sure to ask, namely: What is the pattern of the background of your thought when your special topic, the animal mind, is in the foreground?

It is a pattern moulded on two main principles of interpretation—the organic principle and the evolutionary principle. These I have elsewhere ventured to combine under Emergent Evolution.

What, then, about evolution? It follows from what I have already said that if I now speak of 'organic evolution' I mean the evolution of organisms at any level or organization. That leaves me free to speak of 'biological evolution' distinctive in character; free also to distinguish, when occasion arises, 'evolution' in the race, and evolutionary 'development' in the individual. One wants to preserve conventional usage, and yet to get down to those deep-lying features which are common to all organic evolution in the extended sense of the word 'organic'.

In this comprehensive sense of the expression, 'organic evolution' names an historical process which introduces from time to time something in some sense new. But in what sense new? Let us say new in the sense that at some stage of the historical process it is in evidence whereas heretofore it was not in evidence.

But whence comes the new? If one reply: It is just evolved; that may be merely one way of expressing the observable fact that it appears in the evidence. It does, however, raise the question: What does the word 'evolution' imply? It may imply an unfolding or disclosing of what was already there but hidden from view. This is the earlier meaning of the word 'evolution'.

There arose, however, a discussion among biologists. Here is some character that appears in the course of embryonic development. In the earlier meaning of the

word 'evolution' this implied that it was already there though in some way masked before it appeared in the evidence. If so, it is not 'really new'. But some biologists, Harvey among the first, said: If we keep to the evidence it *is* 'really new'. They spoke of the new ('really new') as 'epigenetic'. So their contention was: Not evolution but epigenesis.

Time passed. An increasing majority of biologists accepted epigenesis. But they liked to retain the old word 'evolution'. So they said in effect: For us evolution shall no longer mean the unfolding or disclosing of something already there but invisible; it shall henceforth mean the becoming of something 'really new'—something that heretofore was not in being but now is in being.

They spoke as representatives of the science of biology. But philosophers, for the most part, held fast to the earlier usage. They said in effect: All that is apparently new 'must be' already there in some wise; for if not, we should have the becoming of something out of nothing.

In many ways this divergence of attitude towards the same array of observable facts crops out in current discussion of a great number of topics. It is very much to the fore when mental development in the individual, or mental evolution in the race, is under discussion. You watch the development of your son as he passes from infancy through childhood and boyhood to adolescence. How much there is that is 'new'! But 'new' in which sense? Newly disclosed in the evidence afforded by his behaviour? Or really 'new' in the sense that it was hitherto not in existence? Was it 'in him' from the first to be 'drawn out' in the course of education? Or is it in him at last (when it comes) though till it comes it was not in him?

One would like to have it, somehow, both ways. But



which way have you had it from me in the foregoing chapter? Quite distinctly, and definitely, as I hope, in the 'really new' way. I there said (p. 42): I believe that those animals, if such there be—and at any rate those human folk—who as adults are reflective, were, at an earlier stage of life, perceptive only. Nay more, I believe that all animals (and human folk) at a yet earlier stage of their life-history were percipient only. And I added: I believe also that this is the order of evolutionary genesis in the life-history of mind on our earth.

I put this frankly in the foreground with reference to our special topic. I now say that this is a foreground expression of the background pattern of my thought. I believe that throughout nature from bottom to top evolution is a process of historical advance in the course of which there occurs from time to time the becoming, or uprising, or outspringing, or, as I express it, the emergence of 'really new' modes of being hitherto not in being. This is applicable to all organisms in the extended sense of the word.

What, then, is the connection between emergent evolution and the organic principle? According to the organic principle: Any organic whole is more than the sum of its parts. This 'more than' is emergent. Emergent evolution along any given line of advance is an enchained and orderly sequence of 'more thans'.

When the Gentle Reader was invited to survey the observable facts of human development from early infancy to adolescence, and was reminded of the alternatives 'in him from the beginning' or 'in him only when it comes and not before it comes', I wonder whether he said to himself: Surely that depends on the point of view from which the array of facts is regarded.

I cannot say more than that it may have been so. If so he may wish to know what I think about it. I

tell him, therefore, that I believe that it does depend on the point of view. But what does this mean?

One has a given array of observable facts. If I suggest that they may be regarded from two points of view, I suppose you to ask: What are they? The two points of view from which I have been led to regard them are (1) the point of view of natural science, and (2) the point of view of a philosophy which includes considerations other than scientific.

One should not pit philosophy against science as if they were antagonistic. Philosophy includes science; but it includes also much that is other than science. And it is this latter moiety which we commonly label 'philosophy'. In that sense philosophy is not antagonistic to, but complementary to, science. Each is organic to the other in the realm of reflective thought.

The difficulty here is to draw some such line between philosophy and science as may be generally accepted. As matters now are, there is very little sign of any common consent—a state of affairs which F. H. Bradley might well have called 'scandalous'. But there it is. What, then, is to be done? I think the Gentle Reader should demand of his writer a clear answer to the question: Where do *you* draw the line? I suppose you to say to me: Take first, science. What do *you* include under science?

First, I should say that what I mean by science is the scientific method of procedure in dealing with the subject-matter discussed in all the several branches of science. I have here chiefly in view the natural sciences, including psychology.

On this understanding, and in view of what I have already said, I include under the subject-matter of science the behaviour of organisms (or, in mechanics, of things) and the relations under which this behaviour is observable, or inferable, in suchwise as to afford a natural

interpretation of the behaviour expressed under suitable generalizations.

Broadly speaking—apart from sundry qualifications and quantifications—the relations in evidence are temporal, spatial, physical, and mental.

Now take Pronuba at the Yucca flower, Tony at the gate, Chica at the suspended banana—or any other instance of animal behaviour you like to select. One has some describable situation. In relation to that situation Pronuba, or Tony, or Chica, or another, behaves in certain observable ways. Suppose that one can say: Under *these* relational conditions (temporal, spatial, physical—including physiological—and mental) *this* is the behaviour that may be expected, *if* our generalizations are correct; then one gives what I should regard as an interpretation which purports to be scientific, or from the scientific point of view.

But our special topic, the animal mind, treated from this point of view, is still in its infancy—perhaps still in its embryonic stage of development. That I should freely admit. That, however, is not the point. The question is: Does an interpretation which purports to be scientific deal with its subject-matter only in terms of such natural relations as obtain? I submit that it does, and that therewith it should rest content.

It is, I presume, sufficiently clear that, in the interpretation I offer, mental relations are taken into account as in some valid sense effective in rendering the behaviour such as we observe it to be. Here many thinkers do not agree. An influential school of 'behaviourists' roundly deny that mental relations, if such there be, are in any sense or in any manner effective. But just now, Gentle Reader, it is I who am at the telephone, not they. My message is that one may speak of mental relations as effective no less 'scientifically' than one may speak of physical relations as effective. If certain changes

in the course of events are observable only when certain specific mental relations (say under perception) are in being; whereas no such changes are observable when these relations, as we judge, are not in being; we have just as good 'scientific' grounds for regarding these mental relations as effective as we have for regarding as effective the physical relations or the physiological relations. You may not agree. But I trust that this telephone message comes through.

When I watch to the best of my ability some man of science *at work*—physicist, chemist, biologist, physiologist, psychologist—what he seems to me to be after is an interpretation in relational terms. As I read, for example, such a book as Dr. Köhler's *Mentality of Apes*, I find that, within his topic, it is the mental relations of Chica or another with reference to 'an objective' that the writer seeks to elucidate. And, as I read the evidence he adduces, these mental relations are no less effective than are the physical and physiological relations within the relational field which constitutes the situation.

## § 5

Natural science, I submit, so long as like the practical shoemaker it sticks to its last, deals with observable changes in terms of the relations which obtain. Among the relations which obtain within living animals, and between them and their environment, are those which we call mental. The question then arises: Are these relations effective in the sense that they should be reckoned with in the interpretation of those observable changes with which natural science deals? Some say Yes; some No. My reply is Yes. On this understanding, therefore, I claim for psychology an autonomous place as a branch of natural science.

The man of science, who keeps strictly to his chosen

task, takes all the changes that occur and the relations in terms of which they may be interpreted, *as he finds them*. But you may ask: How comes it that such and such changes 'occur' when such and such relations 'obtain'?

That, I submit, is a question any reply to which carries us beyond the limits I assign to natural science. Were I to reply that it comes as a manifestation of God's purpose and design, would you not say: *That* is not what I expect you to discuss in the pages of this book? I venture to assume that this is your attitude. If, however, by mutual consent we keep within such limits as I assign to the domain of science, that nowise precludes you or me from overstepping these limits—not here but elsewhere—and entering the wider realm of philosophical inquiry.

That which I seek now to render comprehensible is the point of view from which I urge that *any* reply, theological or other, to the question: How comes it? purports to be not scientific but philosophical. How comes it (in the sense intended) that there are atoms, or molecules, or living organisms? How comes it that there are relations temporal, spatial, physical, and mental? We may ask these questions; but it is not for the man of science to make reply. He is content to say: There they are.

Instead of: How comes it? the same question may be asked in the form: What is it due to? And then an answer may be given in something like this form: Any 'it', or class of 'its', is due to the agency of some It of like name; atoms to Atomicity, molecules to Molecularity, crystals to Crystallization, lives to Life, minds to Mind, and so on.

Fortunately I need not here discuss, within this gossip, the philosophical validity of such notions. My point is that they are excluded from our present purview.

Should it be said that each instance of instinctive behaviour is due to some Instinct; each instance of intelligent behaviour to Intelligence; all reflective procedure to Reason; any felt urge, such as food-hunger or sex-hunger, to an Urge of the same name; let us leave these statements to be debated in philosophical classrooms. No doubt under convenience of literary usage this sort of thing may pass muster; nay more, in the hands of a master may lend dramatic force to his writing. But *me judice* it has no touch with scientific interpretation. You may not agree. You may quote this or that worthy authority in support of a different concept of what falls under scientific method. So be it. I can only repeat that, in this gossip, it is I, Gentle Reader, who am at the telephone.

## CHAPTER V

### *Largely Anecdotal*

#### § 1

In that vein of paradox which gives piquancy to his thought Mr. Crothers reminds us that "to understand poetry is a vain ambition. It is that which passes understanding which has the secret in itself." In like vein I say: To understand the animal mind is a vain ambition. There is much that passes understanding. Of this the animal has the secret in himself. And while the inquiring spirit within us urges us on to penetrate this secret, we feel that some gain in knowledge is attended by some loss in wonder. To quote Mr. Crothers again, we are like the owner of an Elizabethan mansion who "took us to a room where he had discovered the evidence of a secret panel. 'What is behind it?' we asked. 'I do not know,' he answered; 'while I live it shall never be opened, for *then* I should have no secret chamber.'

"There," says Mr. Crothers, "was a philosopher after my own heart. He was wise enough to resist the temptation to sell his birthright of mystery for a mess of knowledge."

We may, however, rest assured that, whether we impute much or little to this or that animal, there will still lurk behind a 'birthright of mystery' that eludes our search. In prosaic terms there is much that we do not, and perhaps cannot, know.

Since, however, we are all dramatists at heart, we fill in dramatically, with such play of artistic imagination as is ours, what lies behind the panel of behaviour which

is all that the eye of direct observation can see. And what we fill in depends on our dramatic insight checked by such generalizations as we have framed with regard to the level of mentality in this or that animal, Pronuba, Tony, Chica, or another.

Moreover, since we are human—and perhaps the more human we are—we may say with Walt Whitman: “I intend to reach them my hand and make as much of them as I do of men and women like you.”

It is not uncommonly said that the more we make of them—that is the higher the mentality we impute to them—the more ‘sympathetic’ is our attitude towards them. But this dramatic sympathy should be checked by some dose of reflective judgment.

Of such sympathetic treatment one may find examples any day. It so chances that in to-day’s *Times* (November 25, 1929) Miss Josephine M. Richardson tells a delightfully dramatized tale of Peter, a black house-cat.

“During the War,” we read, “he entered the kitchen one morning, timidly followed by a wet, bedraggled and evidently half-starved cat. Peter made encouraging noises and guided him straight to the corner where his own saucer of milk stood, purring with satisfaction as the famished creature drank greedily. Afterwards he licked and cleaned him, and they settled down comfortably in front of the fire. We watched the whole process, but I said to Peter that he must not keep the stray long.

“A few days later I noticed that the stray was still there and, in view of the severe rationing to which we were subjected, said to Peter severely, ‘We must send that cat to the Cats’ Home.’ Peter deliberately got up and walked out of the house, the audience chorus-ing, ‘You have hurt his feelings, mum.’ Shortly after I was hurriedly sent for, and there was the stray eating a large and solid whiting, Peter standing proudly by as if to say, ‘I can show benevolence and charity if you



cannot.' An eminent statesman was at that time our next-door neighbour; and a subdued uproar and ejaculations of 'Where has his Lordship's breakfast gone to?' were probably an indication of the source of supply."

In yesterday's *Sunday Times* (November 24), under heading 'A Nice Point of Etiquette', 'Pandora' writes:

"A friend has been telling me about her own dog's peculiar code where the family kitten is concerned. At home the dog and the small cat are on excellent terms. All differences which lead to the term 'cat and dog life' are politely ignored, and they play together quite agreeably. But the family dog has a friend who lives close by. At times the friend is produced on the doorstep or taken to the garden that the dog's god and goddess may pat his head and assure him that he is a nice person, after which ceremony they retire well pleased.

"The other day the family heard a loud barking from their dog and hurried to see what was the matter. The neighbour dog was chasing the cat, and the family dog was not (as you wrongly guessed) offering to defend the cat at the possible cost of a breach with his friend. On the contrary, he remained neutral beyond barking for his mistress to come. Apparently he could not be so false to his race as to defend the cat against his own kind, but, on the other hand, his dog mind could understand that it was not fair to stand by and do nothing when a member of the family, cat or otherwise, was in trouble. Now what about that for dog psychology?"

Turning to the current number of the *Times Literary Supplement* (November 21) I find a review of ten books dealing with Animal Lives. I learn that "Dhan Gopal Mukerji has, in 'The Chief of the Herd,' told the story of Sirdar, an elephant who had been in captivity, had broken loose, taken to the jungle, and was chosen head of a herd on the strength of his guiding the rest into safety when they were being driven into a keddah.

Thence, in the course of the wanderings and adventures of the herd, we learn all about the laws of Hathi governing leadership and discipline, the education of baby elephants, their initiation and acceptance into the community, the habits of the solitaires or rogues, the trials of drought, floods and forest fires, the fights with tigers and wolves, and the battles royal with which the chiefs settle their differences. We are made to feel the extreme acuteness of some of the elephants' senses, their stolid courage and panic fear; above all their overmastering dread of man. The tale is told in the third person; but it cannot quite escape the difficulties of every attempt to get inside the thoughts of the brute creation."

And on the next page, in a review of Some Notable Animal Books, Sir Francis Carruthers Gould's *Nature Caricatures* comes under notice. "His sketches from Exmoor are pure delight. Evidently he loved the birds, and, in less degree, the animals, of that wild country; and, with the possible exception of Mr. J. A. Shepherd, no artist of recent years has shown the same whimsical ability to interpret in black and white their characters in terms of humanity. His preposterous razorbills and puffins as fisherfolk and sailormen; the bespectacled wisdom of his owls; the subtle differentiation of jackdaws, rooks and carrion crows; the silly, self-satisfied ducks and fussy peewits—all alike show an intimate understanding that could only have been attained through long and affectionate study and a genius for interpretation."

## § 2

From the foregoing excerpts—to cull them I had not to go far afield—the Gentle Reader may gather the range of dramatic touch; from delightful fancy to what purports to be an historical rendering of the play of

motives in Sirdar the elephant, Peter the cat, and the unnamed family dog. It is often a little difficult to know just how far it *does* purport to be a faithful rendering of 'historical fact'. But Pandora definitely asks: "What about that for dog psychology?"

I should reply: The observed 'facts of behaviour' not only of this family dog but of 'dogs'—individual dogs, but this specific kind of animal to which they one and all belong—afford the data on which may be based generalizations as to the mentality of 'a dog'. Pandora's pertinent question, then, comes to this: Is the observational evidence in this dramatic incident such as to lead those who have made the animal mind a field of special inquiry to revise or amend generalizations based on thousands of other dramatic incidents?

Again and again one is asked: How do you explain *that* on your principles? The frank answer should be: I do not profess to explain it. But why? Because I have before me only a description of *this* incident or very little more; and what I require is the whole relevant life-history of the family dog—such as I had in the case of Tony at the gate. People often say to the plodding inquirer into matters of great difficulty: This, I assure you, is what I have myself seen with my own eyes. But *you* pose as an expert whereas I do not. And yet . . . The sentence may not be finished. The tone, however, may lead one to supply the finish under imputation. And yet (it seems to run) I'm pretty sure that I'm right and that had you the requisite 'sympathy' with dogs and their ways you would see the matter as I do. Your cold scientific spectacles shut out the warmth of those gently appealing eyes. You deny to the animal a head to think because you fail to appreciate that he has a heart to feel.

I do not treasure up snippets of criticism. But I remember one little bit, given, I admit, more in sorrow

than in anger. "If only," it ran in effect, "the Professor had a little more sympathy, the conclusions he draws would be less warped and more generally acceptable." And, being like others a dramatist at heart, I said to Tony: What do you think of that, my dog?

Of course one must have sympathy of the right sort. That should go without saying. After all sympathy is the affective keystone of such knowledge as we can gain through imputation. We want to get at the animal mind as not only intelligent but also, in a broad sense, emotional. And in many dramatic incidents our puzzlement as to the presence (or absence) of intelligence is accompanied by wondering surmise as to what may be the cognate emotional attitude.

Long ago P. G. Hamerton quoted on the authority of Huc and Gabet this dramatic incident [*A.L.I.* 333]. The long-tailed cows of Thibet, we are told, are so restive and difficult to milk, that to keep them quiet the herdsman has to give them a calf to lick meanwhile. "One day," says Hamerton, "a Llama herdsman came with a long, dismal face to announce that his cow had calved during the night, and that, unfortunately, the calf was dying. It died in the course of the day. The Llama forthwith skinned the poor beast and stuffed it with hay. When the operation was completed, we found that the hay-calf had neither feet nor head. Perhaps it was a pillow that the Llama contemplated. We were in error, but the error was not dissipated till the next morning, when our herdsman went to milk his cow. Seeing him set forth, the pail in one hand and the hay-calf under the other arm, we followed him. His first proceeding was to put the hay-calf down before the cow. He then turned to milk the cow herself. The mother at first opened enormous eyes at her beloved infant; by degrees she stooped her head towards it, then smelt at it, and at last proceeded to lick it with the most delight-

ful tenderness. This spectacle grated against our sensibilities; it seemed to us that he who first invented this parody upon one of the most touching incidents in nature must have been a man without a heart. A somewhat burlesque circumstance occurred one day to modify the indignation with which this treachery inspired us. By dint of caressing and licking her little calf, the tender parent one fine morning unripped it. The hay issued from within, and the cow, manifesting not the least surprise or agitation, proceeded tranquilly to devour the unexpected provender."

Are we surprised, I asked forty years ago, at the want of surprise on the part of the cow? What knows she of anatomy or of physiology? If she could think at all about the matter she might have expected her calf to be composed of condensed milk. But failing that, why not hay? She had presumably some little acquaintance with *putting* hay inside. Why not *find* hay inside; and finding hay, why not enjoy the good provender thus provided? But clearly we must not expect animals to possess such knowledge about matters which nowise concern their daily life of perception.

Hamerton adduced this dramatic episode to illustrate 'the immensity of the ignorance' of animals. "In our estimates of the characters of animals," he says, "we always commit one of two mistakes—either we conclude that they have great knowledge because they are so clever, or else we fancy that they must be stupid because they are so ignorant. . . . The main difficulty in conceiving the mental states of animals is that the moment we think of them as *human* we are lost." Yes. But the trouble is that we cannot think of them in other terms than those of human experience. The only world of constructs that we know is the world constructed by man.

What I here meant is the world *reflectively* constructed in the thought of human folk. It is of *this* 'construct', as I ventured to call it, that most animals are completely ignorant. Perceptive experience they share with us, and in the life of naïve perception they are often 'cleverer' than we are. We should try to realize that what they and we *give* to that which we call the world, and to any given situation, is 'more than' the sum of the parts we or they *get from it*. In that sense we have to deal with the 'emergent more than'. This emergence in mind—in the animal mind and not only in the human mind—I should now emphasize. But that, in any mind-story, we give 'more than' we take I then believed, in common with many of my contemporaries of late Victorian days.

"To Newton and to Newton's dog Diamond," I said [*A.L.I.* 335], quoting Carlyle, "what a different pair of universes! while the painting in the optical retina of both was most likely the same." Different indeed; if we can be permitted, without extravagance, to speak of the universe as existing at all for Diamond, or allowed, except in hyperbole, to set side by side a conception of ultimate generality, like the universe, and 'the painting in the optical retina'. Carlyle's meaning is, however, clear enough. Given two different minds and the same sensory facts, how different are the products. In that formed on sight of the simplest object (I should now say situation) we give far more than we receive; and what we give is a special result (emergent) of inheritance and individual acquisition. No two of us give quite the same in amount or in quality. It is not too much to say that for no two human beings is the world we live in quite the same. And if this be so of human folk, how different must be the world of man from the world of the dog—the world of Newton from the world of Diamond!

## § 3

It is with a sense of relief that one turns from the 'stupidity' of a Thibetan cow to the 'cleverness' of Chica the chimpanzee who, with others, was Dr. Köhler's guest at Teneriffe. It has been my aim to show that the 'stupidity' of the said cow should be regarded as sheer ignorance, and that we must be careful not to impute knowledge, at the reflective level of mental development, where there is no satisfactory evidence that the animal under observation has got beyond the perceptive level of mental development. This presupposes acceptance of the evolutionary canon of interpretation (p. 22) that we should not regard any instance of animal behaviour as the outcome of higher mental processes if it can adequately be interpreted as the outcome of mental processes which stand lower in the order of mental development.

Let us also note this. The said cow may, for aught we know, have been the stupidest cow on record. We must seek information also concerning the cleverest cow on record. We deal primarily with individuals. There are cows and cows; dogs and dogs; apes and apes. To apply the canon of interpretation we should take the higher (reflective) at its lowest, and the lower (perceptive) at its highest. Then we can ask: Is there a distinctive difference, perhaps emergent in character, between one and the other?

For something more than anecdotal information on the mentality of monkeys and apes one consults the records, under experimental conditions, furnished by such observers as Kinnahan, Hobhouse, Yerkes, Köhler, and others. Unfortunately samples of the evidence do not fully bring out the force of the evidence regarded as a whole. One such sample is the behaviour of Julius, a five-year-old Orang-utan, under Professor Yerkes'

observant eye during a long series of occasions [*L.M.S.* 207]. Placed before him are, let us say, a suite of nine compartments with open or closed doors plainly visible. Food could be obtained by passing through the compartment by one of the open doors, and on any given occasion he must pass through *that* one to get it. Matters are so arranged that on different occasions, or 'settings', three consecutive doors are open. They may be situated anywhere in the suite of nine at the option of the experimenter. But only by entering the *left-hand* door of the three can food be obtained; and if he enters the wrong department he is detained there, which he does not like. If Julius, then, has in mind a 'fore-plan of action' (p. 7) he goes straightway to the left-hand open door, no matter what its position may be in the series of nine. It's a pretty simple rule. Always the one to the left.

Of course, in the absence of fore-plan, in a series of, say, ten daily settings he will sometimes be successful; but under fore-plan he will always be successful. What then happened under observation? On some 290 occasions during twenty-four days under varied settings, not once did he score an unbroken sequence of ten successes. On the next day he did so; on the following day he did so; thereafter, as I gather, he habitually did so. "Julius," says Mr. Yerkes, "had solved the problem suddenly, and in all probability ideationally," or, as I put it, reflectively.

There does seem here such behaviour in evidence as to justify one in imputing to Julius a fore-plan of action which *suddenly* took form in his mind. It does seem to afford an instance of a whole which is more than the sum of its parts, in so far as the situation was viewed as a whole in organic relations to the fore-plan. It may no doubt be said that the anticipatory mental plan on any occasion may be only a little in advance of its prompt



execution in act. But what evidence could one get that Julius rehearsed his procedure in mental imagery much in advance of performance in act?

Julius learnt to stack boxes so as to get food suspended above him beyond reach. So too did Chica as recorded by Dr. Köhler. And they learnt to reach their 'objective' in several 'roundabout' ways—that is to say, by indirect means to attain the end in view. But, for the cumulative evidence which leads Dr. Köhler to impute 'insight' to chimpanzees, the reader should turn to his work on the *Mentality of Apes*. I can only quote a sample.

"After the chimpanzees were already familiar with the process of piling one box on another, the whole group was often afforded an opportunity to build up boxes towards an objective suspended at a considerable height in the playground. In time this became a favourite amusement. But we must not suppose that this 'co-operative building' represents any systematic collaboration, with any strict division of labour among individuals. This is, rather, the procedure. The objective is hung in position, and the assembled chimpanzees gaze around for material to use as tools. In a minute they have all rushed under it, one with a pole, another armed with a box; sometimes they drag their tool along the ground, but Chica prefers to lift her box up in her arms, or to balance her plank on her shoulders. Then several of the animals want to ascend at the same time, each behaves as if he alone were about to build and wished to complete the structure quite unaided. If one ape has already begun this constructional exercise, with others building close beside him, as frequently happens, a box is unhesitatingly pilfered from the neighbour's store and the rival architects come to blows; this is apt to interrupt the progress of the work, as the higher the structure, the keener the competition to mount it. The result is generally that the object of the struggle

is itself destroyed in the struggle—knocked over in the mêlée. So the apes have to start again from the beginning, and thus Chica, Rana, and Sultan often give up the labour and struggle, while Grande, the oldest, strongest, and most patient of the four, is left to complete it. In this way she has gradually acquired the most skill in building, although the more impatient animals, Chica and Sultan, are distinctly superior to her in intelligence."

Another dramatic episode. "The whole group of chimpanzees sometimes combined in elaborate *motion-patterns*. For instance, two would wrestle and tumble about playing near some post; soon their movements would become more regular and tend to describe a circle around the post as a centre. One after another, the rest of the group approach, join the two, and finally they march in an orderly fashion and in single file round and round the post. The character of their movements changes; they no longer walk, they trot, and as a rule with special emphasis on one foot, while the other steps lightly; thus a rough approximate rhythm develops, and they tend to keep time with one another. They wag their heads in time to the steps of their 'dance' and appear full of enjoyment of their primitive game. Variations are invented time and again; now and then an ape went backwards, snapping drolly at the one behind him; often the circular common movement would be varied by individuals spinning round their own axis at the same time; and once, as the whole group were joyously trotting round a box, little Konsul stepped to one side outside the circle, drew himself up to his full height, swung his arms to and fro in time to the trotting, and each time that fat Tschego passed him, caught her a sounding slap behind."

What was here the end in view? Might not our friend Mr. Crothers say: Here is one of those dramatic

episodes which are 'their own excuse for being'? What may we impute to each participant in the dance as himself imputing to his neighbours? It is difficult to say.

"They are fond of carrying widely different objects about on the body one way or another. Almost daily the animals can be seen walking about with a rope, a bit of rag, a blade of grass or a twig on their shoulders. If Tschego was given a metal chain, she would put it round her neck immediately. Bushes and brambles are often carried about in considerable quantities spread over the whole back. In addition, string and pieces of rag are to be seen hanging in long strings over their shoulders to the ground from both sides of the neck. Tercera also has strings running round the back of her head over her ears, so that they dangle down both sides of her face. If these things keep on falling down they hold them in their teeth or squeezed under their chin, but, whichever way it may be, they must have them dangling.

"They play, not only with the things they have hanging round themselves, but, as a rule, with other animals' also, and their pleasure then is visibly increased by draping things round themselves. The adult female, Tschego, was often thus festooned when she trotted round in a circle with several of the smaller animals. No observer can escape the impression that the objects hanging about the body serve the function of *adornment* in the widest sense. We can scarcely assume that apes have a visual image of what they look like when dressed up like this, and I have never observed their frequent use of reflecting surfaces as in any way connected with their adornment; but it is very likely that primitive adornment like this takes no note of external effect—I do not give the chimpanzees credit for that—but is based entirely on the extraordinary heightened bodily consciousness of the animal."

I have ventured to condense Dr. Köhler's psychological comments on the observed behaviour of the apes. If I may add a comment of my own, I am led to impute to them some measure of imputation to others of first-hand experience similar to that which is theirs as current enjoyment in their own awareness in perceiving and in behaving. And this, in their case, seems to be distinctively, if only incipiently, reflective. They are, I believe, not only perceptively conscious but also in some degree reflectively self-conscious (p. 58), with some imputation of like self-consciousness to others, including their human companions. There is reflective sympathy.

Just one more dramatic incident in this connection. "One night," says Dr. Köhler, "when it was raining heavily, I heard two animals, who were kept alone in a special place, complaining bitterly. I found that the keeper had left them out in the open, because he had broken the key to the door of that place. I forced open the lock and stood aside to let the two chimpanzees run in as quickly as possible into their warm, dry sleeping-den. But although the cold water was streaming down their shivering bodies on all sides, and although they had just shown the greatest misery and impatience, and I myself was standing in the middle of the pouring torrent, before slipping into their den they turned to me and put their arms round me, one round my body, the other round my knees, in a frenzy of joy. And it was not until they were satisfied in this way, that they threw themselves into the warm straw of their sleeping apartment."

#### § 4

Probably most of us would impute to these soaked little guests who paused to thank their kindly host, some retrospective reference to his previous acts of

which this was a further example. I think that it is justifiable to do so. But it raises difficult questions with respect to the nature and range of memory in animals. These will hereafter call for special consideration.

The point for emphasis here and now is the evidence afforded by the behaviour on which we are led to impute emotional or affective 'states of mind'. Here we are not thinking mainly in terms of end in view. Nay, rather, it would detract from the emotional savour of this dramatic incident if one so much as hinted that the touching expression of feeling betokened only a 'lively sense of favours to come'.

In the 'dance' episode, too, as in that which centres round 'adornment', it is an affective mental synthesis rather than a perceptive synthesis (though that there is also) which we impute to each member concerned in group-action carried out in fellowship. There is not only corporate behaviour; there is not only community in perception, touched perhaps to higher reflective issues; there is also the *joie de vivre*; there is also that which Dr. Köhler speaks of as 'the heightened bodily consciousness of the animal'. May I speak of this as enjoyment? It is distinctively mental; but it, so to speak, tingles throughout the whole body—sense-organs, motor organs, glandular organs, all parts of the body in functional activity; and yet so organically inter-related that the whole of enjoyment is more than the mere algebraical sum of its parts.

We are not here concerned with the bodily accompaniments in the hidden recesses of the body. That is a physiological story. We are concerned with the overt behaviour which lies open to observation and affords grounds for imputation [*A.B.* 317]. "We see," says W. H. Hudson in his *Naturalist in La Plata*, "that the inferior animals, when the conditions of life are favourable, are subject to periodical fits of gladness, affecting

them powerfully and standing out in vivid contrast to their ordinary temper. And we know what this feeling is—this periodic intense elation which even civilized man occasionally experiences when in perfect health, more especially when young. There are moments when he is mad with joy, when he cannot keep still, when his impulse is to sing and shout aloud and laugh at nothing, to run and leap and exert himself in some extravagant way.”

Hudson then contrasts the expression of this gladness in enjoyment among the ‘heavier mammals’ and ‘the smaller and livelier animals’—kittens for example. And he says that “birds are more subject to this universal joyous instinct than mammals, and there are times when some species are constantly overflowing with it”.

At any rate we may say that birds are not less subject to enjoyment at high tide than are other animals. Their behaviour is such as to lead us to impute enjoyment; whatever may be the ends in view we feel justified in imputing, and whatever may be the place we assign to this or that performance in the evolutionary advance of bird life.

Let us take, then, from Hudson,<sup>1</sup> a dramatic incident which may serve as a sample, namely, the behaviour of the Spur-winged Lapwing of La Plata. The “dance,” as the natives call it, “requires three birds for its performance and is,” says Hudson, “so far as I know, unique in this respect. The birds are so fond of it that they indulge in it all the year round, and at frequent intervals during the day, also on moonlight nights. If a person watches any two birds for some time—for they live in pairs—he will see another lapwing, one of a neighbouring couple, rise up and fly to them, leaving his own mate to guard their chosen ground; and instead of resenting this visit as an unwarrantable intrusion on their domain,

<sup>1</sup> *Naturalist in La Plata*, p. 269.

as they certainly would resent the approach of almost any other bird, they welcome it with notes and signs of pleasure. Advancing to the visitor, they place themselves behind it; then all three, keeping step, begin a rapid march, uttering resonant drumming notes in time with their movements; the notes of the pair behind being emitted in a stream, like a drum-roll, while the leader utters loud single notes at regular intervals. The march ceases; the leader elevates his wings and stands erect and motionless, still uttering loud notes; while the other two, with puffed-out plumage and standing exactly abreast, stoop forward and downward until the tips of their beaks touch the ground, and, sinking their rhythmical voices to a murmur, remain for some time in this posture. The performance is then over and the visitor goes back to his own ground and mate, to receive a visitor himself later on."

Here the behaviour is said to be observable all the year round. If we ask: What is the psychological end in view on the part of each Lapwing? can one say more than: To join and take part in the dance? If we ask: What is the biological outcome? we must, so far as I know, be content with re-echoing the question. The point is that we probably do believe that there is enjoyment; that we may fairly impute what I shall call fore-experience having reference to what will come, begotten of prior experience in the coming; that what it feels like in the Lapwing each of us must guess for himself; and that, like many another affective episode, it has in itself its own 'excuse for being'.

Of the thousands of dramatic episodes which characterize the high tides of enjoyment in the so-called courtship of birds, I take as a sample Mr. W. P. Pycraft's summary of Professor Julian Huxley's observations on the Great Crested Grebe.<sup>1</sup> "The most conspicuous

<sup>1</sup> *Courtship of Animals*, W. P. Pycraft, pp. 151-3.

features in this bird (male and female) are the great Elizabethan ruff of bright chestnut and dark Vandyke brown, and the long dark-brown tufts of feathers, or 'ears', which surmount the head. But the satin-like sheen of the white breast and the fore part of the neck and face add not a little to the general effect. These ornaments are worn only during the breeding season. So soon as the fires within begin to burn, the parade of this finery commences, and it would seem that a somewhat protracted dalliance takes place before actual pairing. During the early phases of these performances much play is made with ruffs and 'ears'. The courting pair will frequently face one another on the water, and go through a strange ceremony of head-shaking. To this is soon added a sort of ghost dance, wherein the male suddenly dives, leaving his mate swinging excitedly from side to side. In a moment or two, however, he appears, not suddenly, as usual, but arising gradually out of the water. He seems to 'grow' out of the water. First his head appears, with ears and ruff extended, and beak pointed downwards; then the neck, and finally the body arises into view, till only the extreme tail end remains submerged, so that he looks more like a penguin than a grebe. All the while he is turning on his long axis, as it were, till he gradually displays before his mate the dazzling white sheen of his breast and neck, set off by the rich red chestnut and brown of his face and frills. A moment more and both subside into their normal attitude, shake their heads at one another, and then proceed to feed as if nothing had happened.

"But these quaint antics are only the preliminaries to still stranger. A pair of birds, engaged, apparently, solely in fishing and feeding, will suddenly approach one another and begin head-shaking, each striving to outdo the other. Then the ears, till now erect, are thrust out laterally, and the ruff is still further erected till it



forms, with the ears, a common disc. Then the hen dives; immediately after down goes the cock. After some fifteen seconds or so she appears on the surface again, speedily followed by the cock, who breaks out about five-and-twenty yards off. Each crouches low over the water, and each will be seen bearing a tuft of weed in the beak. As each sights the other a tremendous rush is made, as if they intend to charge. But when about a yard apart each springs up and assumes the penguin position, save that the beak, instead of pointing downwards, is now held horizontally and bears its burden of weed. Still approaching, they eventually touch one another, treading the water and swaying in a sort of ecstasy, all the while shaking their heads from side to side. Then they gradually settle down into the normal swimming pose, though still keeping up the head-shaking; then this, too, subsides, the weed is dropped, and the performers drift apart and begin feeding.

"But no actual pairing accompanies these strange performances. The final rite is associated with a quite different ceremonial, and was witnessed more than once by Mr. Huxley. On the particular occasion which he describes he was watching a male swimming along near the reeds, apparently on the look-out for something, and turning his eyes in the direction of the course, he saw, at some distance off, what he supposed was a dead grebe lying hunched up in the water, with outstretched neck, and ruff and ears depressed. Presently the male swam alongside the body and bent down his head as if to examine it. Then he swam to the tail end, and suddenly scrambled out of the water on to the body; and there, with bowed head and depressed ears and crest, he seemed to stand for a moment. Then he waddled forward over its head and into the water. Instantly the supposed corpse raised its head and neck, gave a sort of jump, and was swimming by the side of its mate.

They had been pairing on a half-made nest, whose surface lay level with the water."

### § 5

We have here the data for piecing together a plain tale of what happens based on what Professor Julian Huxley observed on many occasions. With variations of detail in individual cases it is one common to all Great Crested Grebes. It is predominantly a tale of what the naturalist calls instinctive behaviour. There was, presumably, a first occasion on which each several item of the performance just came for the first time, however we interpret its thus coming. On subsequent occasions we may justifiably impute fore-experience of what was next to follow as it had followed on prior occasions. So far, it is on these later occasions perceptive with reference to what is coming next.

Fix attention, however, on the first occasion on which the pairing act was consummated. Was there any fore-experience of *this*, of which there was heretofore *no* experience in the course of that Grebe's individual life? As the hen lay prone, as her mate scrambled out of the water, did either 'know what was just coming', and this ere it came? Let us leave it as a question—one not to be answered lightly with a jaunty 'of course'.

If, in any case, we speak of the behaviour as instinctive, then some may add 'and biological only'. This I do not believe. I believe that there is sensory percipience of extraordinary richness throughout all the phases of 'courtship'. I believe that there is awareness in behaving no less rich; I believe that there is, throughout, emotional excitement, including the urge of sex hunger; I believe too, that all partial components of the total experience go together as an *organic* whole, of which one may say that it is more than the sum of its parts.

## CHAPTER VI

### *Instinctive Behaviour*

#### § 1

In the foregoing chapter I brought together a pretty varied assortment of dramatic episodes in animal life. Why do I speak of them as *dramatic* episodes? Because, since we are all dramatists at heart, we are prone to regard these episodes as organic parts within the scenes of the drama of animal life as an organic whole. And since in all human drama we impute to the actors on the scene ends in view, motives, reflective endeavour, impulsive or controlled conduct, 'conflicting' emotions, satisfaction in success, depression in failure, and much else, we are prone dramatically to impute the like of all this—more or less 'watered down'—to the animals whose behaviour we observe. I ask the Gentle Reader to consider whether in this respect I correctly report human nature.

We have lately had before us some dramatic episodes in the life of the Grebe during the prolonged period which is commonly spoken of as 'courtship'. I cited M. Pycraft's graphic summary of the birds' behaviour at some length, because without sufficient detail one cannot realize the complexity of the whole procedure.

Let us now try to get down to something which seems to be in evidence at all stages and phases of the whole procedure. There are two parties concerned; and throughout the whole procedure there is subtle interplay between some expression on the part of the male, let us say, and some answering impression on

the part of his mate. I think the sense in which I here use the words 'expression' and 'impression' may be clear enough to afford a basis of departure. The question then arises: Does this or that expressive act on the part of the male justify the inference that it is carried out in view of, or for the sake of, the impression it will make on the mind of his mate, in suchwise as to evoke an answering expression on her part? I feel pretty sure that the notion of courtship, as commonly entertained, implies an affirmative answer to this question, at any rate in the form of: Yes; something of this sort.

But is 'something of this sort' good enough if, as Professor Alexander is wont to put it, we take matters seriously? We must look into *this* matter seriously. And then it seems that, in terms of imputation, even 'something of this sort' implies a very intricate mental situation. To illustrate this let me turn to imputation in human affairs.

If Edwin puts on plus fours and a bright green tie in the hope that this expression of good taste at a garden party will impress Angelina, he imputes to her a mind susceptible of such impression. We who take note of his self-satisfied smile, and her becoming blush, not only impute 'this' mental attitude to him, and 'that' to her (and perhaps jealousy to pouting Chloe), but *his* imputation to her of that impression; *her* imputation to him of this expression of good taste; and—well, whatever it may be that we *do* impute to Chloe as imputing to both of them. Is this pretty complicated? Reflective procedure in any situation which is, broadly speaking, social, is very complicated.

Let us here revert for a moment to the Teneriffe Chimpanzees and to the episode of 'adornment' on their part (p. 88). May I not speak of this as a mode of expression? It seems that this expression, say on

Chica's part, makes some impression on the mind of Sultan, let us say. In this case there is, as I understand, nothing distinctively sexual in the situation. But the question does here arise: Has Chica in mind some reference to the impression her expressive adornment will make on Sultan's mind? If so she must, one would suppose, impute to him perceptive acquaintance with her bedecked appearance. Her attitude to herself as seen by him would be of the same reflective kind as was that of Pepys when he says: "Lord! How fine I did look." It may be so. But Dr. Köhler, who watched and reported proceedings, says: "We can scarcely assume that apes have a visual image of what they look like when they are dressed up like this."

I return now to our Grebes. There is here unquestionably subtle interplay between expression and impression, and between the experience during expressive behaviour and the experience which the word 'impression' names. And, since the affairs of courtship are mutual, both kinds of experience are co-present in organic relationship. The situation is through and through one which calls for psychological and not only biological interpretation. None the less, with my evolutionary canon in view (p. 22), I do not find good evidence that the courtship performance implies reflective procedure with reciprocal imputation of that which I may call the Edwin and Angelina type, or anything of this sort.

If, then, one asks: What is the end in view? At most (I should reply) a perceptive 'there and then' end—just the performance, say, of that jolly head-shaking game each to the other which has 'its own excuse for being', since it is so fraught with mutual enjoyment.

But may one not also ask: What is the *outcome*—not only biological but psychological? Of course one

may, and thus open up the vexed problem of sexual selection.

Is that the question here and now before us? It does no doubt concern us since mental relations are for us in the foreground of the picture. The question, however, before us here and now is: What may we impute to the Grebe? Not, I suppose, the ghost of a notion with reflective reference to sexual selection. What then?

I try (if that be possible) to put myself in the place of the champion of common sense. I seek to see eye to eye with him, at any rate to start with. And I so far sympathize with him as to confess that it goes against the grain *not* to impute to the Grebe some foresight of the consummation of courtship and the grebelets to follow in due course. The more clearly we envisage all that happens between the ringing up of the curtain with immigration of the pair of birds into a breeding area in which a territory is secured, to the fall of the curtain with emigration to a different area; the more clearly we picture the enchained sequence of events enacted year by year; the more vividly does it take form as a drama. And if in *our* minds as spectators, why not in the minds of the actors on the stage? The actors on the stage of human life know what they are about—in varying measure of course but, if they be not mere puppets, always in such measure as to enable them to take some reflective share in the progressive development of the plot. It seems preposterous to suggest that the Grebes, as actors on their stage, have little or no notion of what they are about in the sense of the parts they are playing, if not in relation to the drama as a whole, still in the context of this or that episode of 'ceremonial procedure'.

We hear a Blackcap in full song shortly after his arrival from the south. We look for his mate. *He*

knows, we say, her whereabouts, though *we* may be unable to detect her presence. She must be within earshot, else why this expression in song to win, through impression, her response? But, nowadays, we are told that, when he first sings so full-throatedly, she is as yet far off and will not arrive in the breeding area till many days are past. So perhaps we change our ground. He sings, we say, that when she hears his rich notes she may stay in his territory. He must know that she—some delectable she—is coming ere long; otherwise why should he advertise his presence through song? Expression is still for the sake of impression; if not to-day, then on her anticipated arrival in due course.

Let me now put an alternative interpretation in its extreme form; and let me couch it in terms of expression and impression. Throughout all the varied episodes in courtship there are varied modes of expression: expression in song; in display of plumage; in 'ceremonial performance' which differs in each kind of bird according to its kind. All this expression is dramatically comprised under 'courtship' and *can* be interpreted 'as if' it were the outcome of deliberately reflective procedure.

But it *can* be interpreted otherwise. It can be interpreted 'as if' it were *not* carried out for the sake of the impression it may and does produce. It may be—to borrow a phrase from Mr. Alexander—just 'wrung out of' the bird by the relational exigences of the situation in which he is placed. It may 'just come' he knows not how or why.

And what of the impression? It too may 'just come'. It may be just the impression that is produced. It will no doubt be a condition of a further mode of expression on the part of the recipient. But there may be no reflective reference to its relation to expression on the side of the participant in the established 'ritual of courtship'.

§ 2

The question now arises: How shall we consent to use the word 'instinctive'? I ask you to consent to my use of it as adjectival to 'behaviour'; that is, as the adjective which serves to denote a specific kind of behaviour.

But the adjective 'instinctive' may be, and often is, used to qualify 'experience'. And you may ask: Why not continue thus to use it? Why not speak of instinctive experience on the part of the Grebe? I have no objection 'on principle' to this use of the word by others. But for my own part, in the interpretation I seek here to develop, I have already the word 'percipient' to qualify that evolutionary level of experience, which, as I believe, is co-related with instinctive behaviour. It is, moreover, well to distinguish in this way experience at the percipient level as *imputed* from instinctive behaviour as that which is *observed*.

I ask you, then, to consent to this usage; to allow me to restrict the word 'instinctive' in suchwise as to denote a specific kind of behaviour. That implies that there is a kind of behaviour which is not instinctive. Permit me to speak of it as intelligent behaviour. Then we have (1) instinctive behaviour with percipient experience; and (2) intelligent behaviour with perceptive experience.

At first sight this may seem to imply a separation of behaviour, as an affair of the body, from experience, as an affair of the mind. But no such implication is here intended. For percipience is as closely co-related with affairs of the body, under sensory stimulation, as is behaviour with affairs of mind under awareness in behaving. We are dealing with the Grebe as an organism; as hyphenated body-mind, where the hyphen is the sign of co-relation. There are, for us, no affairs



of the body which are not also affairs of the mind; no affairs of the mind which are not also affairs of the body.

Under instinctive behaviour, then, we direct our attention to the body side of the hyphen. In other words, we take imputation on the mind side of the hyphen for granted.

Now I have taken the courtship performance of the Grebe as an instance of what the field naturalist is wont to speak of as instinctive behaviour. Let us ask him on what observational grounds he applies the adjective 'instinctive'.

As one who makes some pretence to be himself a field naturalist I should reply briefly as follows. First I should say that I do not regard the performance of the Grebe as purely or wholly instinctive. But I do regard its salient features as predominantly instinctive. The question then for me takes the form: What characterizes the behaviour in so far as it is instinctive? In one word it is the *typical* character of the behaviour that earmarks it as instinctive. Necessarily carried into execution by individuals, none the less, in so far as typical and instinctive it affords no evidence of individuality.

What do we find in the Grebe? We find that, notwithstanding some difference of detail on this occasion and that; in this individual and that; in the case of male and female, most markedly in the consummatory act; the typical form of behaviour is substantially the same on all those occasions which fall under the observant eye of the field naturalist.

It seems, then, that in so far as the behaviour is instinctive it matters not whether Mr. Julian Huxley was observing what occurred on this or that occasion in this or that episode of greban courtship. Necessarily enacted by individuals the performance on all occasions

in all individuals under his observation was typical. It is typical, as we say of the species and sex—typical in the same sense as the plumage; typical as the visible expression of a specific mode of organization.

But the courtship behaviour which is typical of the Great Crested Grebe is not typical of all birds. Nay, rather one may say that in each species of birds the courtship behaviour is typical of that species. The word 'typical', therefore, as it is used in connection with instinctive behaviour, means that if we select some natural and allied group of animals we find something common to all the members of that group; something which underlies all their individual idiosyncrasies. But of course this is not all. There must be something else that leads the field naturalist to say: The behaviour I observe is not only typical but typically instinctive.

Before the field naturalist breaks in on the privacy of our Grebes there was much prior life-history. The Grebe is a bird of flight, a swimming bird, a diving bird, and so on. Diving, swimming, flight or specialized modes of wing-action, are incorporated as parts within the whole of courtship performance. It seems that these forms of behaviour, taken severally, are typically instinctive, and are common, with subordinate differences in typical form, to many species of birds.

But here let us pause. The field naturalist breaks in on the performance. In like manner someone might break in on Tony's performance at the gate, or Chica's performance in getting a banana. He might faithfully record just how Tony lifts the latch, pauses while the gate swings open, and then dashes out into the road; how Chica secures the banana with the aid of a stick from the top of two or three stacked boxes. Is that good enough? Is he more than a passer-by, no matter how accurate may be his observations at the time of passing? He is on the spot when Chica, or Tony, or

Grebe does the trick. He was not there when, as we commonly say, one or other of them was somehow 'learning' to do the trick. He is there on the last occasion up to date; he was not there to see what happened on prior occasions.

I have urged that this is not good enough in the case, say, of Tony at the gate. I now urge that it is not good enough in the case of the Grebe. In this case the field naturalist is wont to say that, could we have been present on the first occasion, we should have seen a performance similar in all essential respects to that which Mr. Huxley placed on record. But is that quite good enough? Should he not analyse out the several factors which combine to constitute the performance as a whole?

He may not have opportunities of doing so in the case of the Grebe. But taking one item, swimming or diving for example, as a typical form of behaviour, he may carry out observations under experimental conditions, on such fledgling birds as he may deem typical members representative of the whole group of swimming and diving birds.

### § 3

At some risk of boring you with details I may here quote sundry early observations of my own [*H.I.* 63]. Young Moor-hens hatched out in an incubator and taken to my bathroom when the down was scarcely dry, before they could walk with much steadiness, and then gently lowered into the water, swam off with fair ease. The only difference in their leg-movements from those of older birds was that the strokes were rather more sprawly, and not quite so neat. Under natural conditions the young Moor-hen takes to the water almost at once. A careful observer, Mr. F. A. Knight, told me that he had several times disturbed Moor-hen chicks a day after

hatching, and seen them scramble into the water and swim away. Mr. Knight also noted at the time that one of the chicks, thus disturbed, dived under a log of wood.

Now, I did all in my power to make my little Moorhens dive; hustled them in the bath, clapped my hands, banged the door, and boxed their ears; but all without effect. I played them a few chords on the violin; even that did not scare them. I tried other devices to induce them to dive under obstacles and escape from confinement, but still without effect.

When, later on, the last of the brood was taken to the beck near a farmhouse on the Yorkshire moors, I hoped he would exhibit his natural powers as a diver; but for some time he did not do so. One day, however, when he was about nine weeks old and becoming pretty well fledged, he was swimming in a narrow part of the stream, with steep banks on either side, when an ungainly rough-haired pup came up, bounding and barking, and made an awkward feint towards the bird. Plop! down he went in the twinkling of an eye; and after a moment I saw his head appear, just peeping above water beneath the bank. Though long deferred, here was instinctive behaviour in congenital purity, and absolutely true to type. This was the first time he had ever dived; nor had he ever seen any bird do so.

With reference to flight the following experiment may easily be performed [*H.I.* 70]. If a chick a day or two old be placed in a basket held firmly and then lowered rapidly, the fledgling will stretch out his little immature wings in such an attitude as would make them break his fall were they more fully developed; or he may, if he be a little older, flap them with incipient flight-like action.

My first experiments with more fully fledged birds were with House-Martins. Two were taken from different nests. In one the wings were already well

developed, and it flew round and round the large room. In the other the wing feathers were shorter, and the wings on the whole blunter. This latter one could only flutter along the ground. I then allowed it to flutter over a table, and, when it reached the edge, it flew to the floor with definite progression, alighting awkwardly about four feet from the table. Seeing that it could only flutter along the ground, it was very improbable that this bird had ever left the nest before it was brought to me; but of this I had no direct proof.

I asked a young friend, Mr. H. F. Howard, to watch a nest containing three young Swallows whose parents had built on a ledge in the porch of his uncle's house. He could assure me that they had not, as yet, taken wing in flight. One of them, about a fortnight old, I took from the nest. It clung to my fingers with its sharp claws, but on being detached a foot or so above the floor of the room, it flew off for a short distance. Then, tossed into the air, it flew round three sides of the room, but did not rise much, striking the window-blind (pulled down lest he should dash against the glass) about four feet from the floor, and then coming to the ground. In further trials it alighted awkwardly on the edge of a narrow shelf, and clung there, Swallow-fashion, with tail against the ledge. Experiments with a second bird were to the same effect. With the third nestling we purposely made no experiments. When the others had been returned to the nest, we stood back a little and watched them, but were not prepared for what followed. One got up on to the edge of the nest, paused a moment, and then dived down and flew off. Where it alighted we could not see, but we searched all round in vain, Tony assisting with much zest. He could 'handle' young birds as gently as I could, and bring them to me unhurt.

Mr. Howard, who watched the further behaviour of

the birds, told me that a second Swallow flew off about two hours later. He searched for the truants, and after some time found them perched on the bough of an ash tree fifteen or twenty feet from the ground. The old birds, much excited, were feeding them and "endeavouring to induce them to return to the nest". At ten o'clock they were still absent. Early next morning, however, all three were in the nest, and remained there all day. On the following morning two left the nest in flight. It was not till the third morning that their companion took wing. We had probably antedated by a little the normal age of flight in two of the birds.

In the case of the Swallow, and in most birds, flight is not observable till so many days after hatching. In the domestic chick, as we have seen, the unfledged wings are raised when the little bird is lowered rather suddenly in a basket. In the Moor-hen, so far as I could observe, this is not so. During the early days of life the skinny wings are used with alternating action for clambering through reeds and grass. Their use in flight is deferred for some weeks. On the other hand, in the case of the Megapode of Australia the young, which are hatched in 'mounds' as natural incubators, are already well feathered when they break out from the egg-shell. They soon make their way to the surface; fly well in the course of a few hours; scatter widely; and find their food without the aid of parents, who probably have never set eyes on them.

When we come down to details no one can tell just what will happen in this matter of flight till it is disclosed under careful observation. Then it seems true to type.

#### § 4

What lies open to observation is the behaviour of this or that animal under these or those circumstances.

And the first thing we have to get is a faithful record of the behaviour and the circumstances in some given sequence of occasions. This I call a plain tale of the behaviour. It matters not what instance we take: that of Chica and the banana; that of the retriever with a wounded bird; that of Tony at the gate; that of the Grebe and his mate; that of Pronuba and the Yucca flower; any other example you like to select. In each case there is some changing situation; some changing behaviour in relation thereto. Each affords a starting-point for further inquiry.

We have had before us some cases which are commonly spoken of as instinctive. In so far as they are instinctive the performance of any member of some group of animals is 'typical'. But on further inquiry it seems not only to be typical, but 'repetitive' in such-wise that one may say: As on the last occasion of performance, so too on all previous occasions. One has, however, to qualify this by adding some such words as 'under normal state'.

There is thus a double qualification; (1) 'in so far as instinctive'; and (2) 'in so far as the state of the animal is normal'.

Now I have done my best in what I have thus far said on instinctive behaviour to keep what I speak of as mind-story—that of imputation—out of the picture. But since we are dealing with living animals, there is also a body-story to be told, albeit imperfectly and incompletely, in physiological terms. I think it is permissible here to introduce just a little body-story, adding a reminder that, for me, the living organism is always body-mind, and that there is always body-story on each and every occasion.

The trouble is that the physiological state or poise with which body-story deals varies from time to time, one may even say from moment to moment. One may

so arrange matters as to keep the external conditions in a sequence of occasions pretty nearly constant. But the internal conditions of physiological poise are beyond our control. Since instinctive behaviour is the outcome of conditions external *and* internal, if the internal conditions are different so too is the observable behaviour. What, then, I mean by the qualification 'in so far as the state of the organism is normal' is 'so long as the physiological poise remains relatively constant'.

I propose now to say something on the instinctive procedure of nest-building in birds. Here it is difficult to keep some reference to mind-story out of the picture since imitation, in some sense of this word, has been much brought to the fore.

Writing to Charles Darwin in 1868 Jenner Weir says: "The more I reflect on the theory that birds learn to make their nests because they have themselves been reared in one, the less inclined do I feel to agree with it. . . . It is usual with canary fanciers to take out the nest constructed by the parent birds and to place a felt nest in its place, and when the young are hatched and old enough to be handled, to place a second clean nest, also of felt, in the box, removing the other. This is done to prevent acari. But I never knew that canaries so reared failed to make a nest when the breeding time arrived. I have, on the other hand, marvelled to see how like a wild bird's the nests are constructed. It is customary to supply them with a small set of materials, such as moss and hair. They use the moss for the foundation, and line with the finer materials, just as a wild Goldfinch would do, although, making it in a box, the hair alone would be sufficient for the purpose. I feel convinced that nest-building is a true instinct."

A pupil of mine—J. S. Budgett, whose biological work of great promise was early cut short—made experiments in 1890 with which I was in close touch [*H.I.* 237].



The subjects were Greenfinch, Bullfinch, and Goldfinch. The observations confirmed Jenner Weir's verdict. But in the case of a Bullfinch, in building her first nest "she used neither roots nor twigs, of which there was a plentiful supply. The nest was composed of nothing but dried grass, with a little wool and hair. She laid therein five eggs, two of which hatched, but the little birds soon died. She then began another nest, this time a typical Bullfinch's nest of fine twigs and roots, lined with horsehair. Here five eggs were laid, all of which were hatched, and three reared. She also built a third nest which was perfectly typical of her species."

The point for emphasis here is that the first nest was not typical. Why was that? My friend could not tell. All one can say is that, not infrequently, first performances are not fully typical. Probably the internal state and the external conditions on *these* first occasions are not quite attuned in harmony. But between the first occasion and the second there was no process of 'learning' to use fine twigs and roots. They were just used in the typical way on the first 'normal' occasion, and were so used on the next occasion, and (one believes) would have been so used on all subsequent occasions.

Thus far the bird's procedure in nest-building seems to be fairly straightforward. But the field naturalist tells us that often and often this is not what he finds.

Let me cull from Mr. Eliot Howard's *Introduction to the Study of Bird Behaviour* (1929) some further details of what he has found. I must, in the interest of brevity, rather maul his account of a female Bunting's performance. At an early phase of her proceedings she tears away fine roots, or picks up bits of dead vegetation—material that would do for any stage in the construction of a nest. She holds them in her beak. Beyond that she does not go. Later on she picks up

coarse material of which the shell is composed and carries it now into the midst of this thicket, then into the midst of that. Later still she carries more than one supply into the same thicket, and we find there the platform of a nest. One expects the platform to grow, and grow rapidly. But no! Here she is at work in another bush on another platform; raising this one perhaps to the dignity of a shell.

She forms a platform here, another there; she builds a shell, then a second, perhaps a third—all of which occupies her for some days. Next she works at one of the shells—it may be the first or the second or the third—weaves fine material into it and completes the lining; but returns no more to the other two, makes no further platforms or shells.

For awhile she mouthed dead grass but did not build. So too for awhile she responded in some way to the expressive advances of the male but did not fully receive him. At last, however, she not only responds to him fully but also builds straightforwardly. May not this and that be inter-related?

"There is," says Mr. Howard, "no new external stimulation to account for her doing so [building rapidly straight on]; nor has the material altered. Yet something has changed. Bear in mind that her full response to him implies that some physiological change has taken place and that her building activity synchronizes with her full response; bear in mind that the nearer the time approaches for ovulation the more actively she builds; then remember that females which are late in finding males not only pass through the preliminary stages rapidly but build without repetition or pauses. At least we can say that it looks *as if* the change in the rate of growth of the ova is a physiological correlate of nest-building."

Revert now to the full response of the female in the

consummation of so-called courtship. Mr. Howard's contention is, as I understand, that this finally expressive act, so long awaited by the male with seeming prevision, occurs only when in due course the physiological state of the reproductive system, and all that this entails in the distribution of 'internal secretions', throws the whole bodily state into such a poise that it is, so to speak, normally ripe for the instinctive act. Leading up to this act, or linked with it, the securing of a territory, courtship and much else, are closely inter-related in one organic synthesis.

### § 5

I have invited you, Gentle Reader, to pry for a moment into some of the hidden arcana of body-story. How much or how little you may know of physiology I cannot tell. But presumably you are not prepared roundly to deny that the physiological poise of the living organism really counts on every occasion on which some observable form of behaviour—*any* observable form of behaviour—is in evidence. If you are more concerned to assert that on every occasion the mental poise of the living organism counts no less than the physiological poise, I rejoice. Thus far at least we are in hearty agreement. And you *may* agree with me when I say that mind-story and body-story are not alternatives, one of which must be accepted and the other rejected, but complementary, each to the other, and susceptible of treatment under one method of interpretation in terms of two kinds of relatedness, always co-present and always co-related.

It is on the effective presence of mental relations in the experience which accompanies instinctive behaviour that full emphasis must now be laid.

I have taken the dramatic episode of courtship in

birds as an illustration of that which as field naturalist I should speak of as instinctive behaviour. As psychologist, however, I feel called on to introduce the qualifying phrase 'in so far as the procedure is instinctive'. As field naturalist I apply the adjective 'instinctive' to that behaviour which as a whole and in its main outlines runs its course alike on the first and on all subsequent occasions, in a form which, as in courtship, is typical under normal conditions. But, in my capacity as psychologist—one whose business it is to subject the procedure to careful analysis—I say that in thousands of details the constituent factors of the performance as a whole show unmistakable evidence that in them there is not only percipience but perception also, with fore-experience on later occasions of what is next coming as it has so often come before in the routine of instinctive performance. When once the consummatory act has been carried into execution, there may well be fore-experience of what is just coming on all subsequent occasions.

My point is that in so far as instinctive—that is, apart from supervening perception—the performance as a whole is co-related with experience of wonderful richness and variety.

We come, then, to that which for us is the crucial question: What shall we impute to the Grebe? I speak now for myself in the hope that you may not wholly disagree. First, I impute awareness in behaving as the bird does behave. Secondly, I impute an 'urge' so to behave, in the sense that the bird 'feels like' so behaving, and, if one may so put it, feels like it with subtle changes all the time. Thirdly, I impute what we speak of as an emotional state, with no less subtle nuances, though how to name it, save in a general way, I find it very difficult to say. And lastly, I impute in full measure percipient reference to the situation as a whole.

It is this last on which I wish here to lay special stress. I said that I impute this 'in full measure'. But I doubt whether I am in a position to impute this in full measure. For, in the given situation, I think it highly probable that the sensory percipience of the Grebe far exceeds anything in that line of which I have first-hand experience. Here the Grebe's own experience may well be much fuller and richer than mine. Here one may err in imputing too little as elsewhere one may err in imputing too much.

Let me next emphasize the *situation as a whole*. It is an organic whole of which one may say that it is more than the sum of its parts. As a whole it is what it is; and within the whole each part is what it is, in its relations to all the other parts.

Carry this organic principle a stage further. We want—so far as we can do so under imputation (and no otherwise can we do so)—to get at the mind of the Grebe. We want, if it may be, so to put ourselves (with a difference) into his place as to have, in replica, such enjoyment as he has (as we believe) in so far as the behaviour we observe is instinctive. But the total experience at the time being includes, as distinguishable though inseparable 'parts', awareness in behaving, strongly felt urge (or half a dozen such urges), subtle nuances of emotional state, swiftly changing percipience. All these parts organically combine—combine and not merely commingle—to constitute the Grebe's mind, then and there, as a whole. And, in accordance with the organic principle, this whole is more than the sum of its several 'parts'.

What, then, do I *not* impute? In so far as the observable behaviour is instinctive—and, since that is seen most clearly on first occasions, let me emphasize first-occasion performance—I impute neither retrospective reference to what has gone before (that for me is implied

by *first* occasion) nor prospective reference to what is coming some time ahead. The reference, in so far as the behaviour is instinctive, is to the here and the now of the time being. I call this 'experience at the percipient level'. But I do not say that the mind of the Grebe whose behaviour Mr. Huxley observed had no perceptive experience other than, more than, and supplementary to this.

## CHAPTER VII

### *Further Reflections*

#### § 1

I said awhile since that before the field naturalist breaks in upon, without disturbing, the elaborate courtship of the Grebe, there was much prior life-history from hatching onwards. So far as the evidence goes, the whole courtship performance—that is, the performance as a whole and apart from details—is, in elliptical phrase, unlearnt behaviour. It just comes under certain relational conditions; external in relation to the environment; internal in relation to the current 'state' of the organism.

If we turn from the instinctive behaviour to the co-related experience which we impute to the Grebe, that too is unlearnt. This co-related experience—that which accompanies the instinctive behaviour *as such*—is, however, as one may believe, wonderfully rich; rich in sensory percipience; rich in felt urge; rich in emotional excitement of some sort; rich in awareness in behaving; rich in the current enjoyment as a whole, a whole more than the mere sum of the several items of enjoyment as constituent parts; rich, perhaps, beyond the measure of our comprehension.

I sought near the close of the foregoing chapter to emphasize this wonderful richness. And, with a reminder that the Grebe is not only body but body-mind, I ask: Do you believe that his behaviour during courtship would be such as Mr. Huxley observed if the Grebe were body only and not body-mind? Do you agree with those who say—and there are some who do

say—that all this percipience, this awareness, this enjoyment, may, no doubt, be there, but their presence or their absence makes no real difference? It does not (some say) in any way count in an interpretation of the observable behaviour. All that really counts can be stated in physical and in physiological terms—stimulation from without, excitation within, muscular or glandular response. Some experience there may be; some mental relations there may be; in so far as these ‘may be’s’ are concerned, you may ‘impute’ what you like if it amuses you to do so. But do not delude yourself with the notion that these mental relations are in any valid sense effective; that they make one iota of difference in the behaviour which you observe. We are told on good ‘behaviourist’ authority that this is so. Well, it may be so; but I do not believe that it is so. I believe that mental relations really count; are effective throughout the elaborate procedure of courtship.

But this experience; this percipient reference; this awareness in behaving; this insistent urge so to behave; this emotional state, whatever it may be; all this is unlearnt. In so far as the behaviour is instinctive, the co-related experience just comes without learning; just as, in an elliptical sense, the behaviour comes without learning.

Here I feel pretty sure that you may not agree, at any rate without some further reflection, if then.

What we speak of as ‘learning’ is clearly a matter of experience. It is part of that which I call mind-story. Hence I said that the expression ‘unlearnt behaviour’ is elliptical. It is convenient and conventional shorthand for ‘behaviour which is co-related with or accompanied by unlearnt experience’. I beg leave to go a step further. I have already (p. 101) asked your consent to my use of the word ‘instinctive’ as adjectival to behaviour. I now ask your consent to a like restriction of the use



of the word 'intelligent' as adjectival to behaviour. That still leaves one free to speak elliptically of intelligent behaviour as distinctively learnt. It is then convenient and conventional shorthand for 'behaviour which is correlated with or accompanied by learning through experience or, as we commonly say, profiting by previous experience'.

This leads to some further reflection on what we mean by 'learning' [*I.E.* 35]. There is the sense in which it is said that one learns through doing or behaving. Here learning means *getting* experience. In this sense the Grebe is getting experience throughout the whole period of courtship. In this sense the Moor-hen on the occasion of his first swim, or the Swallow on the first occasion of flight, is getting experience.

But there is also the sense in which it is said that one acts, or behaves, or does this and that, through *previous* learning how so to act. In this sense learning proceeds on the basis of experience *already gotten*.

When one speaks of instinctive behaviour as unlearned one means that it is not the outcome of a *previous* process of learning how thus to behave; it does not depend on experience already gotten.

Little difficulty arises if one pauses to ask: In which sense am I taking the word 'learn'? Suppose, for example, behaviour is in evidence on two occasions in suchwise that on the first it exemplifies instinctive behaviour; on the later occasion intelligent behaviour. And suppose that one then asks: On which occasion did the performer learn so to act? In the first sense of the word he subconsciously learns on both occasions, on the first no less than on the second. But in the other sense he consciously learns on the later occasion only; that is, on this later occasion only does he profit by what he has already learnt on the first.

It is through instinctive behaviour that one *finds*; it

is when intelligent behaviour has appeared on the scene of progressive development that one *seeks*. In finding one learns something new in experience; of seeking the outcome is that one finds it, or the like, again. The observable behaviour in seeking and in finding again, is one of the 'objective' marks of intelligent behaviour.

Bear in mind, Gentle Reader, that these further reflections should be taken in the context of instinctive behaviour and its accompaniment in imputed experience. Rational conduct in human folk and its accompanying reflective procedure is prodigiously complex; and to the Grebe I impute nothing of the sort. When I say, therefore, that one finds or seeks I am putting myself as best I can in the place of such an animal as the Grebe.

Take then, the consummatory act in courtship. At long last the Grebe finds a quite new experience and then first learns what it feels like in its occurrence on the first occasion. Has he been seeking this all the time? I think not. How can he seek an experience the character of which he has had no opportunity of 'learning' in the course of his life up to date? But when he *has* learnt on the first occasion he will doubtless seek to find again on later occasions. While he still behaves on instinctive lines, his behaviour is intelligently endorsed.

But though it is intelligently endorsed it still retains its typical character. And if, as is usually the case, the performance is often repeated, it remains on all occasions, in so far as instinctive, of the same kind. The first occasion still sets the tune to which all subsequent occasions dance, even when, as intelligently endorsed, they dance the more merrily. Hence in its main outlines, as typically instinctive, one may say: Unlearnt on the first occasion it remains in a broad sense unlearnt on the last occasion. On each occasion, first and last, the performer has substantially the same experience—the

same kind of percipience, of felt urge, of affective state, of awareness in behaving.

## § 2

Taking the courtship behaviour of the Grebe as a starting-point, since it is regarded by the field naturalist as typically instinctive, we want to know all we can about the bird's prior life-history. So, in the foregoing chapter, I tried to get down to, and then follow up, some of the contributory lines of instinctive development in bird life—lines common to many kinds of birds, making due allowance for specific differences.

One of these lines was that of flight. Let me now revert to this factor in bird life—say to the behaviour of the young Swallows. They suggest, I think, some further reflections.

Some may say that the conditions of my observations were abnormal; that under normal conditions the parent birds teach their young to fly; that it is through this teaching on their part that the youngsters learn to fly; or that, in any case, there are abundant opportunities for the nestlings to learn to fly by imitating the flight of their parents. If this, or the like, be said, I submit that it calls for some further reflection.

Let us first note that the behaviour of the parent birds is introduced into the dramatic episode. That is right enough. There the parents are in the normal situation. And when, under experimental conditions, they are excluded from the situation, that situation is no longer the same. But does the Gentle Reader suggest that those who are trained to the task of experimental investigation are likely to ignore so obvious a fact?

The question is: Do the parent birds, under normal circumstances, *teach* their offspring to fly; and, if so, in what sense of the word 'teach'? Let me postpone, for

a little, an answer to this question. It will be better to start with 'opportunities for imitation'. No doubt there are opportunities of imitation. But does the young bird reflectively utilize these opportunities with flight as an end in view? Is the imitation intentional and deliberate?

One quite naturally turns to human procedure where reflective imitation is on the *tapis*. Let us grant that young Swallows ere they leave the nest in due course have ample opportunities for watching the departure and return on the wing of their parents. But I asked long ago [*H.I.* 75], and after some further reflection I still ask: Who ever learnt to do a difficult thing even passably well by merely watching the doing of it superbly by another? Let anyone who has never played billiards or lawn tennis watch for a week the most skilled exponents at play, and catch with the eye, if he can, all the delicate adjustments in the performance of the master. Then let him take cue or racquet in hand, and see what he makes of the game without any previous practice. He is helpless. The movements which looked so easy, the delicate turns which seemed so natural, will not come to the beginner, no matter how keenly he has watched the performance by others. To suppose that a young bird can learn to fly as well as my little Swallows did, merely by watching their parents, is to suppose that which human experience and the principles of psychology alike show to be highly improbable.

One here opens up the wide topic of the development of skill, the consideration of which would take us much too far afield. Nor would it be germane to the questions I am here submitting for further consideration. This only need I say. If, after six months on the links, I wish to attain to further skill in playing golf, I watch the play of others to that end. But, even so, my sheer skill, such as it is, just comes only with practice. I learn by doing. And often some further nuance of skill just

comes one fine day with glad surprise. But, alas, how often it has not come to stay! Next week I shall be foozling as aforetime. But I play on in hope. Maybe it will come again. Maybe it will then have come to stay.

Flight exemplifies consummate skill. Is the mental attitude of the bird like that of the golfer writ small? I think not. The golfer's attitude while he learns is reflective though, paradoxically enough, his aim is to get rid of reflection, and not to think about what he does but just to do it, or to let it just come in the doing. The bird does not think about flight. But—and here is a point for emphasis—at the very start he plays his flight game passably well. His behaviour is instinctive. He learns by doing on first occasion without previous practice.

No doubt there is some preliminary expanding and fluttering of the wings on the lip of the nest; and this serves to afford some preparatory experience in wing-action. But actual flight, with its more or less definite and directed progress, must be regarded as far more delicate and definite than such preparatory wing-exercise on the edge of the nest.

And yet how difficult it is for us reflective folk *not* to suppose that the youngster himself looks forward to full flight and himself regards the preliminary wing-exercise as preparatory thereto. Nay, is it not difficult to refrain from going further? The boy sees other cyclists ride; and he says: Some day I too shall ride. May not the little bird, seeing other birds fly, have in mind, though he cannot put into words, some reference to future flight on his own part? Of course he *may*; one *may* impute this to him. But if we do so, we impute to him distinctively reflective procedure. He pictures *himself* in future flight though as yet he cannot fly.

I cannot see my way so to 'water down' the mental attitude of the young bird—if he does look forward to

the attainment of skill—as to render it less than reflective. So too with the parents regarded as teachers. If they teach him to fly in any human sense of the word 'teach' they must, I think, picture him as reaching some such level of skill as they themselves have reached.

You may say that I read into the word 'teach' much more than is commonly meant by those who confidently assert that parental birds (and other animals) do teach their young how to behave, and adduce much evidence in support of this assertion.

Here again a wide question is opened up; but here too its discussion would carry us too far afield. I will only add this. If it be said: There are hundreds of situations in the domestic life of animals wherein the reciprocal behaviour of offspring and parent is what it observably is only in organic relatedness to that of the other party to the transaction; I wonder who it may be that will raise a dissentient voice. The evidence in support of *this* assertion seems to me to be abundant and cogent. But that is not the question on which I am here and now inviting some further reflection. The question I raise is whether the word 'teach' is here in strictness applicable. Does the parent so behave for the sake of giving instruction to offspring, as pupil, so too to behave? If so, as I think, the procedure betokens the reflective level of mentality.

But enough on this head. More generally, what have I been inviting you to do? To trace 'the glory of flight' right back to its instinctive beginnings at the nest-edge. Does one thus get rid of—does one in any degree minimize—the perfected glory of flight? Not one whit. There it is. One seeks only to get back step by step to what it was. What was it? If I say, as an expression of my belief: It was purely instinctive; does this imply that, in its perfected form, it still is, at the time of courtship, purely and wholly instinctive?

Consider [*H.I.* 77] the consummate skill displayed by a bird in fully developed flight at its best—that activity which is performed sometimes with perhaps the maximum, at other times it seems with the minimum, of animal effort. Consider the hurtling flight of the falcon; the hovering of the kestrel; the wheeling of swifts; the rapid dart and sudden poise of the humming bird; the easy sweep of the seagull; the downward glide of the stork; or even, to go no further afield, the smooth descent from the house-roof of a pigeon with scarcely a vibration of the wings till just as it turns to windward in alighting. Do you gather that I am prepared to contend that the exquisitely nice adjustments necessary for all the thousands of nuances of bird-flight are no more than purely instinctive—that the behaviour is nowise intelligent?

Flight is caught up into the whole life of the bird. And the experience which is co-related with this highly specialized form of behaviour is caught up into that totality of experience which is the mind of the bird. And now consider how the instinctive wing-action which leads up to perfected flight leads up also to varied modes of expression during courtship. Look through Mr. H. Eliot Howard's monograph on *The Warblers*. Note carefully the wonderful diversity in wing-expression as it is faithfully portrayed in dozens of admirable plates. Note how it differs in this species and that. Expression and correlative impression render the mental situation during courtship far more than can be interpreted in terms appropriate to the percipient level of mental development, and this only.

### § 3

To the just-fledged Swallow on the nest-rim, when at last he commits himself to the wing, we impute that mode of awareness for which 'desire' is sometimes selected as

the comprehensive name. Desire, in this comprehensive sense, is distinctively mental; but it is not in this sense distinctive of this or that level of mentality. No doubt this word may be, and often is, so defined as to earmark its use at the reflective level only. This usage I prefer. But to come into line with others I here use it freed from such restriction and applicable therefore to a mode of awareness we impute to the little Swallow.

What do we impute? Can one say more than that we impute—for, I take it, we all do impute—such special kind of awareness as one experiences at first hand and labels by this or some other name? But this leaves matters pretty indefinite. One asks, in the case of our Swallow for instance: What does he desire? I suppose the reply will be that he desires to fly. But as yet he has never flown—has no experience of awareness in the behaviour of flight. Does not this call for some further reflection?

I submit that the key-word here is '*reflection*'. We cannot *interpret* what happens save reflectively; and yet what happens is, as I believe, quite unreflective, and, in so far as the behaviour is instinctive, at the percipient level of mentality.

At that level of mentality there is just desire *there and then* whatever that which we so name may 'feel like' in the first-hand experience we impute to the Swallow. Reflectively, however, we cannot tolerate confinement to the 'blind and ignorant present' of the merely 'there and then'. We must e'en ask with respect to any now-occurrence: What was precedent thereto; what will be consequent thereon? We lay out the course of events in a space-time plan of events, through and through reflective in origin. We look backward to events that are past; forward to events that are to come. We look forward to the outcome of present desire in the Swallow on the nest-edge, and speak of it as flight; and when



flight comes in due course we look backward to precedent desire which, we say, is 'fulfilled' in this mode of behaviour.

And then on further reflection—it needs some further reflection—we perhaps realize that, on the evidence, the Swallow may just *live* forward, and neither *look* forward to the outcome nor look backward to the precedent desire. He may be no more than currently aware in living forward at the here and now of the passing moment. The future and the past may, for him, not yet have been opened out. He may be 'cabined, cribbed, confined' in the 'blind and ignorant present'.

This expression—'the blind and ignorant present'—is often so used as to label that which is regarded as a palpable absurdity from the psychological point of view. What does it mean? From the psychological point of view the 'present' is the 'now' of current experience, a brief span of that which we reflectively speak of as 'time'. It is technically called the 'specious present' of which I shall have more to say later on. Suppose, then, that a chick pecks at something for the first time in his life. He does so at the 'now' of his first-hand experience. He does so *at sight of* the something. In that sense he is nowise 'blind'. We impute to him visual percipience. In what sense then *is* he 'blind'? In the sense that he may have no fore-sight, or other form of fore-experience of what follows. In that sense he is 'ignorant', since he has not yet learnt in the course of behaving what does follow. Such an interpretation of that which one observes may be erroneous. But it is nowise psychologically absurd. It is an open hypothesis, to be considered in the light of such presumptive evidence as is available.

Consider, then, the evidence. We have been submitting to the touchstone of reflection some first occasions of typically instinctive behaviour under normal conditions.

I select two instances: that of the consummatory act in courtship pretty late in the life of the Grebe; that of the Swallow when, quite early in life, he takes wing. In each case, as we may observe, there is some preparation for the coming event. In bodily and mental organization the bird is living forward from birth onwards. If that organization be not ripe for the event; if the internal bodily state, and the accompanying awareness in desire, be not normal; the event does not come in typical form. But it normally does come. The Swallow dives from the nest-edge; the prolonged courtship of the Grebe reaches sudden and brief consummation.

Each, be it noted, on some first occasion. What does this imply? On the interpretation of the facts which I offer; on which, whether you accept it or not, I am asking you to reflect; the implication is that, in the performance of the instinctive act, the bird neither looks forward nor looks backward. Immersed in the palpitating present there is, for the bird on such an occasion, literally '*no time*' in which to look backward or forward.

How can the Grebe or the Swallow look forward to an event the like of which is, in its finished form, wholly new to first-hand experience? How can one or other look back on an event the like of which has never fallen within that experience?

But here, Gentle Reader, you will, as I surmise, say: The whole position is altered if, on yet further reflection, we realize that ancestral or inherited memory may play a part of which thus far scarcely so much as bare mention has been made.

That is so. It introduces, however, a supplementary hypothesis. The altered position is that we must reckon with the possibility, perhaps for you the probability, that the mental organization of the Grebe is such as to retain a memory (in some sense) of parental procedure in courtship. Hence he can look back on parental consum-

mation, and look forward to like consummation on his own part. Far from being 'immersed in the palpitating present' his time-range embraces a past and a future to which we can assign no limit.

It is clear that we cannot discuss this hypothesis until we tackle the difficult problem of memory. Since I see no valid grounds for its acceptance I must ask leave to proceed on the assumption that sufficient unto the experience of the animal is remembrance of events that have occurred within the span of his individual life-history.

#### § 4

There are still one or two matters which call for some further reflection. My belief is that instinctive behaviour is accompanied by, or co-related with, percipient experience which, though it is restricted to the passing 'now', is none the less wonderfully rich as an organic whole; which is more than the mere sum of its constituent items. Furthermore, my belief is, that, in the case of our Grebe for example, there is much intelligent behaviour which is accompanied not only by percipience but by some measure of perception also.

It is, I have urged, on the first occasion of the performance of some instinctive act that the co-related experience is percipient only. On subsequent occasions a like act—or one that is not readily distinguishable under observation from that on the first occasion—may be co-related with perceptive experience. If so, these later acts may be partly instinctive and partly intelligent; and references to the situation may be partly percipient and partly perceptive; where the word 'partly' is subject to the organic principle. Since what is observable is behaviour it is *there* that we must seek presumptive evidence of some measure of perception.

The question which calls for some further reflection is this: Are there any animals whose behaviour throughout life is instinctive only? It is said that this is so in the case of some insects—that they learn nothing in the sense of profiting on later occasions by experience gained on prior occasions. It may be so. But I am increasingly doubtful whether this is so.

It may, however, be said that there are at any rate some lowly animals—*Amoeba* and *Stentor*; perhaps *Hydra*, and others of that ilk—in whose case the evidence of intelligent behaviour is, to say the least of it, inconclusive. There I agree. But, I ask: Should we speak of such behaviour as instinctive? I should not do so. Nor should I speak of any behaviour in plants—in orchids, for example, during process of fertilization—as instinctive.

Thus we come back to a definition of instinctive behaviour. Let me say then, in further definition, that in the context of this book I have chiefly in view those animals whose behaviour in the course of their life is first instinctive and later intelligent; whose level of mentality is first percipient only and later perceptive also; and (I may add) whose nervous system is of that kind which is technically called 'synaptic'. On these terms instinctive behaviour is a stage in the development of those responsive acts which at a later stage take on the characterizing features which lead us to name the behaviour intelligent. This, I think, should enable the Gentle Reader to grasp how we now stand in the progress of our discussion.

It only remains to emphasize my use of the word 'instinctive' as adjectival to behaviour. You may say that this excludes such 'instinctive experience' as is predominantly emotional, when you speak, for example, of your 'instinctive dread' of a snake or perhaps a mouse. It precludes your saying that sex-hunger, for instance,

is an 'instinctive' urge or desire to which the observable behaviour of a stag in the rutting season is due. And then you may ask: Is it not somewhat arbitrary to restrict the use of this adjective to behaviour only?

That is a pertinent question to which I must briefly reply.

Any definition of a word which is taken over from current speech to be used in a technical sense (sometimes more extended in meaning, sometimes more restricted) is in some measure 'arbitrary', and is subject to common consent on the part of those who so define it. The question, then, is: Why do I so define it?

My aim is to distinguish the behaviour one observes from the experience one imputes; and I start with the behaviour one observes. I find that, in practice, those who, in the study of animals, seem to me most closely to hug the facts *do* start with behaviour and then seek to interpret it in relational terms. I try to follow their lead. I find that, in the context of their special inquiry, they *do* label certain modes of behaviour 'instinctive'. I try to make clear to myself and to others what are the characterizing features of these modes of behaviour. I have placed before you the outcome of my efforts along this line of approach.

One more point, though I am loath to fan the flame of an old controversy. It may just possibly be said that my treatment of instinctive behaviour implies that it is 'no more than compounded reflex action', or, perhaps, that it is 'due to' reflex activity.

I submit that it implies nothing of the sort. I take it that the reflex act is a physiological concept. It is reached by teasing out more or less isolated processes in the total integrative action of the nervous system. The 'simple reflex' is a convenient and arbitrary abstraction. May one not stop far short of such abstraction as this? May one not take the behaviour of Tony at the gate

without prying into the physiology of his nervous system? May one not say: That is another story which may be left for subsequent discussion?

It may be said: You are simply evading the issue. Do you assert that in instinctive behaviour there is 'no more than compounded reflex action'? I reply that I do not. I believe that in physiological regard such modes of instinctive behaviour as I observe express the functional integrity of the organism as a whole. If, within that whole, sundry reflexes may be disclosed under analysis, well and good; still that whole is more than its parts; and, in this organic sense, when Blackie instinctively pecks at a rice-grain we are not dealing only with the mere algebraical summation of a dozen or more instances of reflex action; we are dealing with the 'more than' that characterizes instinctive organization.

## CHAPTER VIII

### *The Dawn of Intelligence*

#### § 1

The question that was raised at the close of the foregoing chapter may be stated in a slightly different form. And since it is one in which the Gentle Reader may, not improbably, be interested, I will say a little more on the topic.

If we take some example of instinctive behaviour, such as the flight of a bird, and, diving below the surface into the arcana of physiology, trace matters downwards, we reach a relatively simple, but none the less orderly, assemblage of reflex acts which play their parts in the integration of the motor responses that severally contribute to the behaviour as a whole. Can we, then, draw some line of demarcation between the relatively simple reflex action below this line, and the relatively complex instinctive behaviour above this line? And if so, where, and on what grounds?

Half a century ago J. G. Romanes drew the line in suchwise as to make the absence or the presence of consciousness the distinguishing character. "Reflex action," he said, "is non-mental neuro-muscular adjustment, due to the inherited mechanism of the nervous system. Instinct is reflex action into which there is imported the element of consciousness."

He here invites us to step across from body-story to mind-story. Of reflex action below the line there is, he says, no mind-story. But when one passes above

the line of demarcation he says: Now there is instinct; now there is mind-story.

I take his statement merely as a peg on which to hang what I have to add in the light of what I have already said. I have repeatedly expressed my belief that instinctive behaviour is richly accompanied by consciousness in the sense of awareness in experiencing. Apart, then, from the phrase in which the word 'imported' is introduced, I am ready to follow Romanes on my own terms. But since I believe that subconscious awareness accompanies reflex action and that it contributes to that which accompanies instinctive behaviour, I am unable to follow him in characterizing reflex action as 'non-mental' in the sense intended; cannot therefore accept the line of demarcation as he draws it.

I confess that I know not where to draw a line, emergent or other, between what one may elliptically speak of as (i) reflex awareness and (ii) instinctive awareness, as the concomitants of reflex action and instinctive behaviour respectively. Nor, when I turn to body-story, do I know where to draw a line of demarcation between the physiological processes which are analytically distinguished as reflex and those synthetic net-results which find expression in such an instinctive form of behaviour as that of flight. There seems to me to be one progressive advance in organization which may be discussed from two 'aspects'; the story of which may be told in terms of diverse and co-related relations of the mental and of the physiological kind respectively.

But questions of a philosophical kind are opened up. Romanes spoke of reflex action as 'neuro-muscular adjustment due to the inherited mechanism of the nervous system'. And then it may be said: *There* is the really essential point. We are bidden to regard reflex action as 'mere mechanism'. Reflex acts are supposed to be aggregated, and to work, in some merely



mechanical fashion. Only when consciousness is 'imported' do we have something so utterly different as instinct. Hence it is clear that the real line of demarcation is between the kind of 'driving force' (technically 'efficient cause') which is postulated in this case and in that.

Whereupon the flood-gates are thrown open to philosophical controversy. Realize, it is said, how inevitably you are placed on the horns of a dilemma. If instinct be no more than reflex action you must interpret it mechanically. If it be more than reflex action you must acknowledge the operation of some other driving force (or forces) to which your so-called instinctive behaviour 'is due'.

Here, Gentle Reader, you know my attitude though you may not be in sympathy with it. I submit that the whole controversy, with the consequent dilemma, is not concerned with matters of science but with problems of philosophy. I submit that the whole field of this controversy is strewn with non-scientific adjectives ending in 'istic'—materialistic, mechanistic, vitalistic, animistic, finalistic, and the like. I submit that the domain of science may be so characterized—that by not a few men of science it is so characterized—as to exclude from its purview all questions with regard to 'driving force' in the sense intended, and only to include within its purview an interpretation of observable facts in terms of relations—temporal, spatial, physical, and mental.

On these grounds I ask leave to be excused from entering this arena of philosophical controversy in the pages of this book.

## § 2

To get a plain tale of instinctive behaviour, or behaviour which is predominantly instinctive, we turn to

the records of field naturalists. Should the Gentle Reader feel some surprise that I have devoted so much space to a few examples illustrative of this part of my topic, I ask him to take a comprehensive review of these records of animal life and make a rough estimate of the proportion of space therein devoted to behaviour predominantly instinctive. It is surely a large proportion.

In the great majority of cases the field naturalist who observes and records some typical performance is not in a position to say whether the instance he witnesses is 'first-occasion' or 'later-occasion' behaviour, though sometimes, in some insects for example, it is pretty clearly the only occasion. His chief aim is faithfully to record what is typical in behaviour, as this is intimately connected with what is typical in external appearance, in structural build, and in the general working of the organism as a going concern. He duly notes variations, seasonal or other, in all these respects. But he regards them as variations from the type. He takes into full consideration the environment, and the situation in which the animal behaves. But he regards it as that which affords adequate physical stimulation to the senses; as that which is the normal prerequisite to appropriate and adaptive response in behaviour. He naïvely accepts the environing events as the source of influence on the body, and takes it for granted that there is mental reference to these events on the part of animals as there is on his own part. In current phrase his attitude is frankly 'objective'. And so long as he deals with observable behaviour, this objective attitude is what we expect and require of him. But in his capacity of field naturalist we should not require or expect of him any pronouncement of opinion on subtle psychological questions unless he has earned the right to speak with some authority by specialized study in this field of inquiry.

Then he can speak not as field naturalist only but also as comparative psychologist. But it needs special training—training not only in top level human psychology, but especially in bottom-level psychology so far as it can be deciphered at the very early stages of mental development.

It seemed to me, some forty-odd years ago, that I was sadly lacking in such training and that others—well, *never mind about others*. It seemed to me, therefore, that, if it took up much time for some years, I must try to dig down to foundations. To that end it appeared that a somewhat intensive study of young birds, hatched out in an incubator, and carefully, even meticulously, watched during the early hours and days of their free life, might prove helpful to me, and perchance to others, in throwing some light on mental development and on the principles under which it may be interpreted. There were already on record many observations along this line of approach. But while keeping these in view, I thought it advisable to start afresh and rely chiefly on observations of my own. Forgive, Gentle Reader, this touch of personal history.

### § 3

I realized of course—it was obvious enough—that the youngsters submitted to observation were under abnormal conditions in that all parental influence was excluded. There were, however, counterbalancing advantages. One could watch their progress independently of such influence. One could compare their behaviour with that of birds reared under normal conditions, and thus draw some conclusions with respect to the part which parental influence plays.

In any case I set forth to learn all that I could from the little orphans under my charge. What, then, in

general terms, did I seek to learn from them? First I sought to get a plain tale of their behaviour, let us say during the first week. But so much is going on at the same time during that eventful week that it is not easy—I have found it very difficult—to piece together the tale of what observably happens. So much goes on all the time; and yet one has to give it in bits. What grew upon me year by year as I watched the early behaviour of some hundreds of birds of different kinds was a realization in this field of inquiry of an application of the organic principle (though this was not then clearly formulated), namely, that the meaning of a tale as a whole is far more than is apparent in the sum of the bits one can tell.

Still as a general impression this soon stood out: I could say with some confidence that the behaviour on the last day of the week is markedly different from the behaviour on the first day. Pretty obvious so far, you may say, and scarcely worthy of statement as a general impression. This difference, however, is such as to lead me to infer that, at some time during the week, there is a radical change in mentality; that, under observation, there is an advance from instinctive behaviour to intelligent behaviour; and that, under imputation (as I now put it), there is a co-related step upward from percipience to perception.

I state this as a general impression, using the nomenclature which I have now been led to adopt, so as to bring this brief summary of early results into line with what I have said in foregoing chapters, much of which, you may say, savours largely of general impression. On this head I venture to add that general impressions may often be of peculiar value if they present an organic whole which is more than the sum of the partial details which they embody. Of course much depends on the general impressionist. There are the first impressions

of the tyro at his job. There are the last impressions of one who has spent years at his job. I give you, for what they are worth, my last impressions. None the less it is imperative that details should be furnished if one seeks to pass on to others one's general impressions.

Now the behaviour of the last day, as was that of the first day, is an expression of the bird's physiological organization under the stimulating influence of surrounding physical conditions. There is during the week progressive change in this physiological organization. Hence we find those who contend that an interpretation of all that happens can be given in physiological terms; and that only in these terms has an interpretation any scientific worth. I agree that an interpretation of all that happens can be and should be given in these terms. I dissent from the 'only'. But that is body-story. I seek to render an account of mind-story which may be, so far as is possible, conformable to the method of science.

In any case, what I am chiefly concerned to learn, under close observation, is what sort of mind-story I may impute to a birdling during the first week of his free life. So with this end in view I keep the external conditions as constant as possible, or at any rate, so far as I can, within experimental control. I watch the behaviour from hour to hour and from day to day; for after all this behaviour is all that I can observe. And what do I find? I find that at the end of the week the chick does much which is not merely a repetition of what he did at the beginning of the week. No doubt this can be interpreted in terms of some change in bodily organization. That I do not deny. But does this suffice? It looks as if there was also some change in mentality. This 'as if' is the verbal sign of an hypothesis. My hypothesis is that during the week there is a change of mentality, a passage from the

level of percipience only to the level of perception also.

What kind of behaviour is the week-end expression of this change in mentality? I noticed [*H.I.* 152] that one of my seven-days'-old chicks pecked repeatedly at something near the corner of the turned-up newspaper which formed the wall of the yard-square enclosure in which he and others were penned; the paper being propped against improvised supports. The speck that caught Blackie's eye and elicited the pecking response was the number of the page. He then transferred his attention to the corner of the page, which he could just reach. Seizing this he pulled at it, hauling the paper down, and thus formed a breach through which he escaped into the wider field of my room. I caught him, restored the paper to its former position, and put him back near the same spot. He went at once to the corner, pulled the paper down, and escaped. He was recaptured and set down in another part of the pen. Presently he came round to the old spot, reached up to the corner of the newspaper, pulled it down, and again effected his escape.

Take this at its face-value as just the behaviour which I observed. 'Objectively' regarded it is not typically instinctive. It is not such as may be seen in any chick, on any occasion, under similar circumstances. I saw it in Blackie, but in no other chick. He repeated like behaviour several times. Of half a dozen chicks, his companions in the pen, two followed him out through the breach. They showed no sign of 'imitating' his procedure in effecting a breach. This performance (and many another) was intelligent and individual, not instinctive and typical. In elliptical phrase it was learnt behaviour.

So too was Tony's behaviour at the gate. It was intelligent, individual, learnt. But Tony had experi-

ence of what might be going on in the road outside the gate. Blackie had as yet no experience of anything outside his pen. Put yourself in his place. He had never been out of the pen; he could not see over its walls. We say, perhaps, that he wanted to escape. What did 'escape' mean for Blackie? What relational urge thus to behave did he experience in awareness? Was it curiosity? Submit curiosity to analysis. Concerning what was he curious? May it have been fresh food in pastures new? Such questions in plenty may arise, if you *do* put yourself in his place—if you say: Now I *am* Blackie; what does it all feel like; what, as Blackie, is my first-hand experience?

To put oneself in his place. That, Gentle Reader, is what one has to do, or endeavour to do, at all stages of our inquiry. And we naturally direct our attention to the outcome of behaviour—Tony in the road, Blackie beyond bounds. Then we are prone to say: Precedent to this outcome there 'must have been' a like end in view and a wish to attain it. That is where we may go wrong. On the first occasion Blackie may not have sought this outcome; he may just have found it. But having found it on this occasion he may have sought to find it again on subsequent occasions (p. 119). Thus, on the evidence before me, did I interpret his demarcation performance.

Here let me pause. Much of Blackie's behaviour throughout the week retains its typical character. It is that of *any* chick. But much of it presents a new and individual character. It is that of *this* chick, Blackie. The behaviour is typical in so far as it is instinctive; individual in so far as it is intelligent. It may, however, be said that what is typical is observed in individuals—say Blackie and Whitey; and that what is individual may be typically intelligent and observed alike in Whitey and Blackie. And so matters become somewhat mixed.

But is not this because the word 'individual' is used in two senses? In one sense Blackie and Whitey are two several individuals; but in another sense their typically instinctive acts show no observable evidence of individuality.

In the latter sense, may it not be said that individuality as contrasted with typicality bears a mark of freedom? At the beginning of the week Blackie seems to be instinctively bound to do this or that. At the end of the week he has in some measure escaped from this bondage and is individually Blackie himself and not Whitey. He is no longer confined within the blind and ignorant present (p. 126). The dawn of intelligence is the dawn of futurity. Having instinctively found he now seeks to find again—for example, escape from the pen.

How did this escape from the pen start in behaviour? Apparently the starting-point was pecking at the number on the page; then pecking at and seizing something else—the corner of the newspaper; whereon the rest followed. Pecking may therefore afford a clue to further interpretation.

The little dramatic episode we are considering occurred at the end of the week. How is it connected with what occurred at the beginning of the week?

So much has happened. The life-and-mind of Blackie or another is fuller and richer than it was soon after hatching on many lines of advance organically interconnected. There is, however, one line of advance in evidence at or near the outset of free life in any bird or in any animal—that of which the biological outcome is the nutrition of the body. As life proceeds this line is intertwined with many other lines. It is interwoven with the flight-line of the Swallow that catches hundreds of insects on the wing every hour of the day. Traced back to its beginning it starts in this case with mere



gaping for food under adequate stimulation. Even here it may be said that to get food is the precedent end in view on the part of the nestling that gapes; or it may be said that the subsequent outcome of this instinctive behaviour is food just found in the mouth, though even here there may be 'fore-experience' of food in the mouth when once there has been actual experience of finding it there.

#### § 4

Let us now follow up in the chick that line of behaviour the outcome of which is nutrition. It may throw light on the passage from instinctive behaviour to intelligent behaviour, and on the ascending step from the stage of percipience to the stage of perception in the course of Blackie's mental development.

For a few hours after hatching we may fail to find evidence of this behaviour on the food-line of advance. We say that the little bird is not yet hungry. Perhaps we know that there is still a good store of food-stuff in the yolk-sack which shortly before hatching was tucked into the abdominal cavity. That, however, is body-story. To the mind-story hunger is a contributory factor. At an age, in hours, when we feel justified in imputing this mode of awareness, we take the chick from the dark incubator drawer and introduce him to the world of vision. Already percipient, here is for him a new mode of definite percipience. We arrange a visual situation. He responds by pecking at this or that with fair but not unerring accuracy. He seizes this or that; and another mode of percipience 'just comes' through the stimulation of receptors in the mouth. Let us provisionally speak of it as taste. Some of the 'thises' or 'thats' are swallowed, some dropped, some thrown on one side with a shake of the head. We

impute affective tone, pleasurable or the reverse. Awareness in hunger; percipient reference; awareness in behaving; affective tone; that all-overish state of enjoyment which is co-related with living; such is the first-hand experience I feel justified in imputing to the chick but a few hours old.

Think reflectively in a little further detail. You and I, as observers, analyse the situation. There is *this* which arrests the bird's gaze; 'thats' around it; a visual background. Yes, for *us*. But for the chick? Probably just an unanalysed whole of sense-experience at the level of percipience, co-related with the total stimulation of all the receptors then and there stimulated. It is, of course, in respect of the eyes a visual situation; but it is also, for example, a tactual situation with sensory items from the feet on which he stands. When we think of the whole as comprising, and yet more than, the sum of its constituent parts we think organically—or in modern phrase in accordance with *Gestalt* theory.

No doubt we say, and say rightly enough, that he behaves, on such an occasion, at sight of some 'this' which *we* distinguish from the rest of the situation and name. But such distinguishing analysis is a reflective process on our part. For Blackie the 'this' is disentangled from the situation through pecking at it.

What, then, is the *this* at which he pecks? Anything that arrests his wandering gaze whether it will be, when taken into the mouth, nice, nasty, or neither the one nor the other. Anything? Yes, anything; so long as it is of about the right size and at about the right distance—as *we* say. Distance; size. What knows *he*—a chick some few hours old—of size or distance? About the *right* size. Right for what? To be taken into the mouth and swallowed? But on the first occasion he has never taken anything into the mouth or swallowed it.

Difficult as it may be, you must try to put yourself into the place of the chick.

Turn now to the behaviour you observe—or perhaps only read about. Just pecking, you say. Oh no. First arrest of gaze; then, in most cases, a step or two towards 'this' (whatever 'this' may be); then a momentary pause in postural poise; and *then* the peck. Label these *a*, *b*, *c*, *d*, and add, if you like, the taste in the mouth, *e*. Now think—I am asking you to think—of the first occasion. On this occasion, so long as we deal with individual experience, on what grounds may one impute, at stage *a*, 'expectation' of what will come at any after-stage *which has never yet come?*

On this first occasion the behaviour is typically instinctive. Instinctive is that in arrest of the wandering gaze; instinctive that of stepping forward, that of postural poise, that of pecking; that of swallowing some 'this'. At the percipient level of mental development is all the co-related experience we impute—or, let me say, I impute. This experience includes awareness in behaving instinctively. In shortened form, then, we have seeing, pecking, tasting, swallowing on the first occasion. But what about subsequent occasions? So long as the behaviour is typically instinctive we shall have, under like conditions, the same sequence on all occasions; seeing, pecking, tasting, swallowing; and so on, *da capo*. But is that what we find?

What *do* we find? This for example. I must go into a little detail. I so arrange matters that 'this' shall be a grain of boiled rice. During the first two days of the week I find much the same sequence on all occasions, first and last alike. But ere the morning of the third day I soak the rice-grains in quinine or quassia so as to render them bitter to my taste. And on that day I place among 'thats' only medicated rice-grains. What happens? Once or twice these medicated rice-grains

are seized at sight. Once but seldom twice—I speak as I have found—they may be swallowed. In the course of two or three occasions there is a change in the observable behaviour. The rice-grains are not eaten. If taken into the mouth they are ejected, thrown on one side with a shake of the head, followed perhaps by a wipe of the bill on the ground. Sometimes the chick runs towards a grain, stops, does not peck, but shows the behaviour of ejection. Later the rice-grains are ignored. [M.C. 138.] But even then there is (I think) aversion of gaze in place of the clinging of gaze which accompanies approach, pecking, and seizing.

It seems, then, that there comes a stage at which, in place of sight followed by swallowing, there is sight followed by ejection. There is not repetition on all occasions of what occurred on the first occasion. There is not typically instinctive behaviour only. There is something more than instinctive behaviour.

But, you may say, the conditions have been altered; and under altered conditions the behaviour is different. That is all that has happened. You have rendered nice grains nasty, though they look just the same. To nasty rice-grains the behaviour is different. That is all.

If you think that is all, you miss the main point. During the first two days one has seeing, tasting, swallowing. At the beginning of the third day one has (after quinine medication) seeing, tasting, ejection. But, after that, one has seeing (*no tasting*), ejection, or, later on, just letting alone. That is the point. On the first two days there is at sight seizing and swallowing of rice-grains. Then there is at sight seizing and ejection of medicated rice-grains. Under changed conditions the taste of the rice-grains is different; different too is the observable behaviour. But what follows thereafter? Rice-grains are no longer seized at sight. They are no longer tasted. And yet on two or three occasions the

observed behaviour is that which was in evidence when they were tasted—that of ejection or at any rate not-seizing. And later on the behaviour is that of aversion from rice-grains if it be only aversion of gaze.

In the earlier stages of behaviour taste is a link in the chain. In the later stages of behaviour, taste (actual tasting) is not a link in the chain, for the nasty rice-grain is not taken into the mouth. There must, however, be some link in the chain. What, then, is it? May one say: Fore-taste is a link in the chain? May one say: There is not only the current experience at the time being; there is also revival of precurrent experience? May one say: There is no longer instinctive behaviour only with percipience only; there is also intelligent behaviour with that fore-experience which is one of the distinguishing marks of perception? May one say: In this little episode on the line of nutrition we can trace in some detail that passage from percipience to perception; that concurrent passage from instinctive to intelligent behaviour; that new light shed on the pathway of life which in picturesque phrase I speak of as the dawn of intelligence?

I have been summarizing some net results of observation. You may ask such questions as these: Are there not individual differences among chicks in respect, for example, to the lasting effects of 'medication'? If a chick has learnt to avoid medicated rice-grains does he never thereafter eat plain-boiled rice? Can he not re-learn to eat them freely? And so on.

There *are* marked differences of individuality in any batch of chicks. The lasting of the effects of medication *does* vary so that one may have progressively to grade the bitterness. A chick *can* be re-trained to eat rice, for example, if he be kept very hungry, if he be provided with little else to peck at, if he be with other birds who are eating it freely. There is much more to be said

in detail; much more to be learnt in detail. I must ask you to take what I have set down as a brief summary of some salient results of inquiry.

§ 5

Permit me here to suppose that the Gentle Reader is sufficiently interested in Blackie to wish to make pretty sure that he grasps what I am desirous to emphasize. Putting myself in his place, this is what I think he may say.

You have played, he may say, on the use of the word 'learn'. Your Blackie, you tell us, does not learn what a rice-grain (or anything else—a maggot or a ladybird) tastes like until he tastes it. But when he *has* tasted it he profits by this experience, and in a further sense has learnt *thereafter* to go for it or to avoid it as the case may be. You distinguish, in effect, learning to taste and learning to avoid on taste.

It seems, then, that in one sense of the word 'learn' Blackie is gaining new experience along what you speak of as the 'lines' of sight and of taste; and that, in the further sense of the word, he is learning how to act or to behave. So long as he behaves instinctively he does not learn in this further sense. Hence, in this further sense, you say that his instinctive behaviour is unlearned, although it is through this unlearned behaviour that Blackie is gaining new experience and is learning in the first sense.

There is, however, you say, an observable difference between the instinctive behaviour with which he starts and the intelligent behaviour which is in evidence even in the course of a few hours. How, you ask, does this come about—this observable difference in what he does later on from that which he does at first?

You then go into details. You tell us that at first

he goes for *anything* ('of suitable size') at sight; and this you ascribe to instinctive behaviour. On tasting it, however, he either eats it or does not—eats it if it be nice; leaves it alone if it be nasty. This, too, in either event, you ascribe to instinctive behaviour.

You have, therefore, at first three forms of instinctive behaviour; (1) that at sight (pecking and seizing); (2) that on nice taste (gulping down); (3) that on nasty taste (ejection from the mouth). And you tell us what you believe Blackie's behaviour would have been had he continued to act instinctively. On every occasion there would be (1); the rice-grain, nice or nasty, would be seized. Then if nice it would be swallowed, under (2); if nasty it would be ejected, under (3). In either event the behaviour would remain typically instinctive.

This, however, is not what you find. What you find on later occasions, you tell us, is this: Still on sight either (2) or (3)—one or other; but with this difference. If (2) the sight behaviour (pecking and seizing) is still in evidence; whereas if (3) this sight behaviour is *not* in evidence, nor can there be any taste stimulation since the rice-grain is *not* taken into the mouth.

So, in order to interpret this change of behaviour, you introduce the notion of 'fore-taste'. To the Blackie that shows aversion from medicated rice-grains; to the Blackie that goes vigorously for maggots and eschews or ignores ladybirds; to the Blackie that behaves intelligently; you 'impute' a specific mode of 'fore-experience' of what would come under normal routine as on prior occasions it has come. You say that if this fore-taste be nice the behaviour is that of seizing with added zest; whereas if it be nasty the behaviour is that avoidance without pecking.

In this way you seek to render an account of the 'passage' from a merely instinctive Blackie to a thus far intelligent Blackie; or, from Blackie (i) at the per-

ipient stage of mental development to Blackie (ii) at the higher level of perception.

But more, far more, than this lies behind. You believe (do you not?) that of like nature in principle—that is, through the advent of 'fore-experience'—is the passage from a percipient stage to a perceptive stage of mental development in the life-history of every animal that is in any degree intelligent. In each and all of them there is that which you call picturesquely the dawn of intelligence.

Yes, Gentle Reader, that is my belief. But I fully realize that you may say: Rather a large and sweeping hypothesis on rather slender and narrow foundations. Step by step we are led down to a chick, a medicated rice-grain, and fore-taste. And then we are invited to jump to the 'dawn of intelligence' throughout nature.

*I can well understand this standpoint as one from which the position of affairs may be viewed. Mine is different. Pardon a personal note in re-statement.*

I look out on a world of animal life in which there is behaviour, instinctive and intelligent. There is a difference; and this difference does not seem to be one of physical and bodily relations only. Mental relations seem to play some part. But what part; and how? Is there a passage from one to the other in the course of evolutionary advance? If so, where is the relational switch-point that gives a new line of advance?

I study behaviour in the wild. But I am still puzzled. The available data within the reach of a field naturalist do not furnish quite what I want, or all that I want. There are unfilled gaps which elude continuous observation. Why not closely and continuously observe under experimental conditions the early life of some animals? Try (among others) birds. Some years of rather exacting work follow—work with interpretation in terms of mind-story steadily in focus.



Hundreds of episodes (in scores of animals) intricately intertwined, each calling for such interpretation. Anything common to all of them? Yes, something. But what? It seemed that in all cases the behaviour is initially instinctive, but often, later on, intelligent. Is there, then, something of the mental kind that seems always to be present when the behaviour is intelligent? There is. But how name it? I now name it 'fore-experience'. There seems to be, in intelligent procedure, always some form of fore-experience of that which is coming in the course of normal routine. But what is the good of it? In what way is it effective? If this fore-experience is co-related with bodily events which are linked with behaviour that *forestalls the coming event*, may it not then be regarded as, in a valid sense, effective?

Meanwhile, with this as a guiding clue I keep in touch with the observations of field naturalists. Does it seem that here also the intervention of fore-experience is the mental criterion of that perception which accompanies intelligent procedure? It does seem so whenever one can put matters to the test. I feel justified, therefore, in inviting you to regard this hypothesis as universal in its range.

But it has to be illustrated in some concrete case. That which I have selected as among the most telling is the fore-experience exemplified by fore-taste. Thus I bring you down to Blackie and a medicated rice-grain. But not only on this, Gentle Reader, or on any single instance, do I base the hypothesis that with fore-experience comes the dawn of intelligence.

## CHAPTER IX

### *Association*

#### § 1

It may be said that much that I have written above about Blackie, with reference, for instance, to the look of a rice-grain and its taste, may be interpreted in terms of association. Many psychologists nowadays rather fight shy of association. But the word still has vogue. It is not likely to drop out of the current vocabulary of psychology, at any rate the vocabulary of that which M. Santayana calls 'literary psychology'. In that context it is used with special reference to the association of ideas.

We all of us know, or think we know, what we mean by an idea. Some of us impute ideas to Tony and to Blackie; to the two-years'-old child and to the two-months'-old infant; some of us do not. So the question arises: What is it that we do (or do not) impute under the name of 'ideas'?

This word, too, is one of those of which some psychologists nowadays fight shy. But perhaps the Gentle Reader does not like to drop the acquaintance of so old a friend. And I take it that what he commonly understands by an idea is pretty well anything that in some way comes to mind. When 'this' suggests 'that', both 'this' and 'that' are ideas. How comes it, then, that 'this' *does* suggest 'that'? In quite a number of ways; but all show that there is a link or bond between 'this' and 'that'. Let us say that they are linked in the bonds of association. "Here," as Hume said, "is a

kind of attraction, which, in the mental world, will be found to have as extraordinary effects as in the natural, and to show itself in as many and as various forms." Here is an 'associating quality by which one idea naturally introduces another'.

Let me quote [*P.T.* p. 78] as a trivial illustration of how one idea naturally introduces another a quite apocryphal extract from a schoolgirl's letter. "Yesterday I walked by the pond, and found it, oh, so hot even for July. We skated there together last year. It was just like flying through the air. I can conceive nothing more joyous than a bird's life. Is it not sad that the poor soft things should be plucked to stuff a feather-bed? But for myself I prefer a mattress. I sleep better, and there is nothing more invigorating than sound sleep. It gives an edge to one's appetite for breakfast. We always have porridge here, which reminds me of our delightful holiday in Scotland—the land of Burns and Walter Scott. I think the mountains far grander than those of Cumberland, which were the inspiration of Wordsworth. I have been reading some of his poetry, but much prefer Tennyson. Arthur is so delightfully mythical. I can't understand anyone preferring Browning"—and so on.

Here we have examples of what Hobbes called 'the wild ranging of the mind' which may be discussed under the headings Contiguity, Similarity, and Contrast. But I do not impute to animals any such wild ranging of the mind. In common parlance, no doubt, one would not speak of my supposed schoolgirl as a typically reflective person. And yet I here introduce her as such—as one who has reached the reflective level of mental development. There is a pretty wide range of reference in space and time; there is quite definitely a concept of self in the picture; these are marks of reflective procedure.

The older writers, however, did not distinguish reflection from perception. For them perception was always more or less touched with reflection, as it is in adult human folk. For them association covered the whole field of mental life. And it did so in a 'natural' sense. Herein lies the sting of Hume's speaking of association as a kind of 'attraction' which, in the mental world, has as extraordinary effects as in the natural. These effects, he says, "are everywhere conspicuous; but as to the causes, they are mostly unknown, and must be resolv'd into original qualities of human nature, which I pretend not to explain."

So the associational fat was in the philosophical fire. The merely 'natural' interpretation offered by Hume and his successors was in due course dubbed naturalism and associationism, where the 'ism' is the sign of philosophical controversy (p. 134).

Into this controversy I do not feel called on to enter, though I feel sure that I shall be dubbed by some folk an 'ist of that ilk. More consonant with my purpose is it to ask: Is such an interpretation mechanical, and if so in what sense?

I suppose James Mill may be regarded as a stalwart champion of association. Of him Hoffding said (1900) that, following Hartley, he lays great stress on the point that "several ideas and feelings may enter into so intimate a union with one another as to become inseparable, while the new totality, thus formed, possesses qualities which are not possessed by any of its parts". "The new qualities of the product cannot be deduced from the factors." "It has been thought," says Hoffding, "that a psychical faculty must either be absolutely original, or else that the factors which make up its existence must be of the same kind as itself. Psychical events have been compared with mechanical conjunctions, while in the great majority of cases they should

be conceived in analogy with chemical events." He has here Stuart Mill's doctrine of mental chemistry in view. My point is that the organic principle was for both Mills, father and son, already above the horizon. Under association there is more in the whole than there is in the algebraical sum of the parts. But with mental chemistry there was more fat in the philosophical fire. I will not further burn my fingers therein.

## § 2

I ask the Gentle Reader to take what follows in this section under the caption of what Mr. Crothers speaks of as 'interchange of confidences'. I am feeling my way in this matter of association subject to the distinction I draw between unreflective and reflective procedure; and I am inclined to define 'association' in such wise as to restrict it to the perceptive level of mental development. That means that, at the reflective level, there is always 'more than' association as thus defined. Since, however, one who is reflective is always also perceptive, his aim should be analytically to distinguish in his own first-hand experience perceptive association, and to show how reflective procedure supervenes thereon.

Now what often occurs in the ordinary course of our mental affairs is that some 'idea' suddenly crops up. Then, in reflective mood, one says: I wonder what led me to think of *that*. How, when, and where did *that*, of all things, become linked by a 'bond of association' with just this? How comes 'this' to suggest 'that'? Often one cannot say. One must leave it as a 'must have been'. Sometimes, if one is given that way, one can run it down, at least as a 'probably has been'. Let me give an example from first-hand experience.

Thus it runs in brief record. Many years ago I went with a niece to a chamber concert. A string

quintette of Onslow's was rendered. "I suppose you knew it, Uncle." "No; I don't think I ever heard it before, though of course it has 'Onslow' written all over it. But," I added, "what is puzzling me is that I had all the time a vision of monkeys climbing a trellis archway."

Puzzles call for solution. So I wrote to my father, enclosing the programme. Had I perhaps heard it with him? "Very likely you heard it during the short time that Dr. R. with his double bass joined our quartette party which generally met that year at Mr. W. J.'s house. We certainly played it then. But then you were only eight years old."

Eight years old. I am back in the past. Familiar drawing-room. Small boy. Must be amused. Picture book. Got it! Monkeys climbing a trellis archway. And ready to climb again to Onslow's music after more than forty years.

Now here we should distinguish the intentional and deliberate process of putting oneself into the past, from the establishment of an association along the auditory and the visual lines of sensory acquaintance. The former is distinctively reflective; the latter, as such, may be at the unreflective level of mental process. When the association was established both sense-lines—music and monkeys—were 'strong'; under revival the music line was strong, the monkey line was attenuated or weak—in visual imagery, as we say.

An association of music and monkeys strikes one as oddly irrelevant. One asks: What is the good of it? Wherein lies the sense of it? The point of the illustration is that, so far as I could discover, there was no sense in it—no linkage of *reflective* ideas. In the concert room: music (*this* music) strongly presented to the ear; and monkeys (*these* monkeys) more weakly re-presented in visual imagery. Given Onslow's quintette

the monkeys just came. Why? Because long ago they had chanced to climb to this tune.

I believe that such associative linkage as this is established at the unreflective level in a mind that is already reflective. None the less, in accordance with the organic principle, it is not quite the same as it would be in a mind that was not already reflective. Is not this a difficulty that faces us throughout? We can get at other minds only through imputation; we can get at our own minds only through introspection. But, in our own minds, we can see what goes on at the unreflective level, only, so to speak, through spectacles coloured by reflection. We make allowance for reflective colouring as best we can. But it is questionable whether we can ever quite get rid of it.

Such association as I have sought to illustrate by music and monkeys just comes unreflectively. Is there not much of this kind in our daily life, though we may be unable to say when and where it first came? It came without our bidding in the course of the development of perceptive reference to what was going on around us. It came also in the course of the development of our subjective enjoyment. As a boy of eight I enjoyed listening to music, and, even then, string music came first. As a side issue those monkeys on the trellis pleased me as 'jolly good and alive'. Each played its part in my current enjoyment as a whole. In that sense each was relevant to the other in rendering my enjoyment what it then was.

But there was no reflective relevance—no sense in it. I have never utilized music and monkeys, save as above for purpose of illustration. A dramatic artist can so utilize that which music and monkeys illustrates as to render it relevant to his purpose. Did not Wagner make deliberate and effective use of this kind of association? Recall his use of the gold-motif when *Mimé* is

chanting soft wheedlings to Siegfried. By utilizing association of the music and monkeys type he reveals Mimé's thought of the gold all the time.

But here he skilfully leads us into the realm of reflective 'ideas'. Is this kind of organization—that of reflective ideas—of like nature to the association of unreflective 'ideas'? Or is reflective organization always something more than association only?

It is, I believe, always something more than association only. It is a higher mode of mental organization. I seek an illustration. How comes it that *this* springs to my pen as I write?

Drive my dead thoughts over the universe  
Like withered leaves to quicken a new birth.

Can I interpret this on lines similar in principle to the association of music and monkeys? I cannot do so. They came to me as reflectively relevant—under 'contrast' if you like. Were 'dead thoughts' and 'withered leaves' merely associated in Shelley's mind in 'music and monkeys' fashion? I think not. It was their relevant bearing on 'to quicken a new birth' that raised them to reflective status.

I might then ask: How came they to his mind at the poet's bidding? Or did they come to him unbidden just because he was Shelley? But this would not here be in place. It takes us far beyond the reach of the animal mind. It is, however, in place to realize that there is something far more in reflective organization than there is in unreflective association as I venture here to distinguish them. And it is in place to ask whether there is evidence of this something more—no doubt only in incipient form—in animal life—in the case, let us say, of Chica, the chimpanzee, or of Julius, the orang-utan.



## § 3

May I now for my purpose in hand—an interpretation of the animal mind—so restrict my use of the word ‘association’ in this context as not to include more than is exemplified in my first-hand experience by music and monkeys? To raise it, however, to the status of a general principle of interpretation, I should say: Any mode of sensory acquaintance having reference to some situation, and any mode of awareness in meeting the exigences of that situation, may be associated with any other mode, if they be concurrent on some series of occasions, sometimes on one occasion only as a limiting case.

Note that modes of reference to the situation, and modes of awareness on the part of the animal in the situation, are alike included. We must square this as best we can with the notion of ‘ideas’, or, preferably, drop the notion in the present context. In terms of ‘this suggests that’ (p. 143) note that ‘this’ is always a *renewal* of some strong experience, while ‘that’ is always a *revival* in relatively weak form. That such renewals and revivals there are in the normal course of nature we may accept without question. Note also that such renewals and revivals are *within experience*. Association is an affair of the mind; and in mental terms it should be interpreted.

To exemplify association in such a mind as we may fairly impute to the dog I cite first a pretty ordinary instance which I have elsewhere placed on record (*I.C.P.* 118].

When I was at the Cape I used to take my two dogs up the Devil’s Peak, an outlying spur of Table Mountain. There were several places where I had to lift them up from ledge to ledge since they could not scramble up by themselves. After the first ascent

they always remembered these places and waited to be lifted up.

On one of our early ascents one of the dogs put up a young coney, or rock-rabbit, and they both gave fruitless chase down a by-path. Subsequently they always hurried on when they neared this spot, though they never again saw a coney there. I think the last time I took them up was about three and a half years after the coney hunt. So long, I then said, had the association remained uneffaced.

In this case it is probable that the revival took the form of that which I speak of as *fore-experience*. On reaching the ledge there was, I believe, in Toby's mind and in Ginger's, at least *fore-experience* as part of that which we express when we speak of expectation of how the situation is going to develop on this occasion as it developed on a previous occasion. And this I impute to the dog on the basis of my own first-hand experience in climbing from ledge to ledge. But I think that in the *fore-experience* I impute to the dog there is less than there is in my expectation in similar circumstances. In his case there may be little or no anticipation of, or prospective reference to, what will follow some little time after he has been lifted. His *fore-experience* may be closely tied to the current present in which behaviour is still in progress.

My point is that I cannot get on, in my interpretation, with less than revival in *fore-experience*. It clings close to the present as that which William James, in conversation on this and the like forms of behaviour, spoke of as "an ever-present fringe of futurity, in all that a conscious being does".

I ask, then: Of what is there this mode of *fore-experience*? I reply: Of some form of *behaviour-awareness* just coming but not yet come. It probably is supplemented by a preparatory twitching of the muscles

toward the response. There may thus be incipient renewal of the response. In any case it comes in this mode before it comes in the fullness of behaviour. It comes in fore-experience under revival ere it is endorsed in the actual experience which is awareness in acting. It is pre-current to current experience in actual behaviour, just as, in Blackie, the fore-taste of a juicy maggot is pre-current to actual taste in the mouth.

Thus I lead up to the association of some mode of sensory acquaintance—it may be under sight, or smell, or touch, or hearing, and so on—with awareness in behaving appropriately to the situation. Since sensory reference *to* the situation is concurrent with behaviour *in* the situation; and since both sensory reference and awareness in behaving are alike ‘strong’ on the first and some early occasions; there is ample opportunity for the establishment of unreflective association on these occasions.

It is on the early occasion or occasions that ‘bonds of association’ are established—that ‘this’ is linked with ‘that’; it is on later occasions—when ‘that’ is suggested by ‘this’—that there is evidence that they have been established. And in animal life the only evidence that some specific association has been established is afforded by the behaviour one observes. Thus in the case of my two dogs the only evidence that I had that there was an association of by-path and coney hunt, was that when they reached the spot on later occasions they raced off as they had done on previous occasions.

#### § 4

Some further light may be thrown on what happens in normal life if we briefly consider a few instances of the way in which the trainer of performing animals utilizes association on their part to subserve his purpose

as a showman. As showman he knows his audience; as trainer he knows his animal. As trainer-showman his aim is to 'teach' the animal to do something which will lead members of his audience to say: Marvellous instance of rational thought; go and see for yourself. So he advertises Calculating Horse; Dog who knows three languages.

The audience are shown on the blackboard a little sum with half a dozen arithmetical steps, to which the answer is Eight. It is shown to the horse and the showman appeals to him. He stamps out Eight with his hoof.

When the dog comes on to the platform a member of the audience demands: French for the purring of a cat. The dog runs along an alphabet of letters at the back of the stage, fetches, and brings forward in order R.O.N.R.O.N. Wonderful, says the inquirer; didn't know it myself (great applause). The showman may perhaps be in like case. Then he must resort to gag. "I must ask you, Ladies and Gentlemen, to ask no questions about *cats*. The dog will sulk and refuse to answer them. Just look at him."

How is it done? Some 'this' to suggest the 'that' which is expressed in behaviour. For instance, while the horse is pawing the trainer looks at him with level eyes; when he reaches Eight the trainer drops his lids. The horse stops tapping. While the dog runs over the alphabet the trainer gives a tremble of a shake of his gloves. The dog brings forward that letter. And so on. Dropping the eyes; a shake of the gloves; something of that sort. In each case an associative clue to behaviour.

That, I think, is always the kind of thing that goes on when one gets behind the scenes. The trainer relies on the delicacy of perception in the animal; on an association of 'this' mode of sense-perception with

'that' revival expressed in behaviour; on some urge so to behave; on affective awareness pleasurable or the reverse under skilful admixture of reward and punishment. As showman he relies on eluding the vigilance of the members of his audience, and, in a tight place, on clever gag. It is a complicated business and more may lie behind. But, in our context, the foundations seem to be those of unreflective association.

But off the stage, where there is no intent to deceive as legitimate business on the part of the showman, some evidence points in the same direction. I was told, for example, on good authority, of how Kepler, Dr. Huggins the astronomer's dog, would yap out the answer to a four-or-five-stage sum; and how on one occasion he yapped out six. The correct answer was Three. No, said Huggins, Six. He had omitted one stage of 'division by two' as he admitted on revision. The inference is that some unintentional flicker on the face of the master gave the dog his clue to stop yapping.

A quarter of a century ago a *cause célèbre* was that of Kluge Hans the calculating horse. The whole story is told by Oskar Pfungst and may be read by the curious in *Clever Hans* (English translation, 1911). It seems that there is little ground for imputing intentional deception to Mr. Von Osten the enthusiastic owner, or to some distinguished men of science who gave a good 'pass' to Hans after examination in arithmetic. But comparative psychologists have, for the most part, concurred in Professor Stumpf's verdict as pronounced in the Introduction. "A horse," he says, "that solves correctly problems of multiplication and division by means of tapping. That was the riddle. . . . And its solution was found in unintentional minimal movements of the horse's questioner."

Not reflective understanding but delicacy of unre-

flective perception characterizes associative organization. In auditory perception it is often intonation of the voice that tells.

Among my long-ago friends were an ardent Conservative and his fox-terrier Cæsar. When his master solemnly said 'Gladstone' the dog fell limp and helpless; when he said brightly 'Disraeli' the dog sat up, hopeful and alert (biscuit). "Would he do it for me?" "Try him." Yes. It came off according to programme (biscuit). Then, mimicking my friend's *intonation*, I said solemnly 'Disraeli'. Down he fell. Then brightly 'Gladstone'. Up he got (biscuit from me; protest from master). With another dog a somewhat similar experiment did not come off so well. He simply looked puzzled. And *his* master said, "Jock thinks you *rather* a fool."

I do not suggest that dogs are unable to distinguish the sound of 'this' word and 'that', though I was unable to get Tony to respond differently to 'biscuit' and 'whiskey'. But my finding is that they respond unreflectively to sound, especially intonation, and not reflectively to sense or significance in a sentence. Their 'understanding' of what we say to them may, I think, be interpreted in terms of unreflective association without imputing to them the 'more than' which betokens the reflective level of mentality. But what about apes? I do not know. It may ere long be shown that here is a wedge of entry to the higher stage of mentality.

Lord Avebury trained his poodle Fan to bring cards on which were printed in large letters such words as 'food', 'out', 'door'. In 113 trials during twelve days, with twelve cards from which to select, she only made two mistakes, one of them bringing 'door' instead of 'food'. She then got what she wanted, say 'tea'.

Here we have communication—a call for what she wanted. Of 'communication of ideas' in this sense

there is abundant evidence. The difficulty is to interpret the evidence in terms of imputation. When I was at the Diocesan College, at Rondebosch, near Capetown [*A.L.J.* p. 345], a retriever, Scamp, used to come and sit with the lecturers at supper. He despised bread but got an occasional bone, which he was not, however, allowed to eat in the hall. He took it to the door and stood there till it was opened for him. On one occasion he heard outside the barking of the other dogs. He ran round the hall, picked up a piece of bread which someone had dropped, and stood with it in his mouth at the door. When it was opened, he dropped the bread and raced off into the darkness to join the other dogs.

The bread-business seemed to be the communication of his wanting the door to be opened. When Ginger waited at the ledge to be lifted, he seemed to 'ask for it'. What goes on in the dog's mind on such occasions? It is hard to say what, if anything, he imputes to us who respond to his appeal. But this question takes us a little outside our topic—associative organization.

## § 5

One of the many difficulties that attend an attempt to deal with association in animal life is that which arises from our strong analytic bent as reflective interpreters. We distinguish that which is 'given' through the several 'avenues of sense'—sight, touch, taste, smell, hearing; the traditional five senses. We carry the analytic process further, and distinguish colours, scents, tones and so on. And then we say: Now we have the 'thises' and 'thats' which are associated.

But if we think also in terms of awareness and of experiencing, then, as M. Bergson so cogently urges, we turn away from the chopped-up, analytic 'ideas' of the

intellect; we turn towards the interpenetrating factor of wholeness.

As I read the modern *Gestalt*-theory it invites us always to keep the 'pattern' of mind as a whole in full view. It is subject to wholeness, comprising the parts in one organic synthesis, that I submit that any mode of experience may be associated with any other mode, if they be concurrent on some series of occasions (p. 158).

It is difficult, however, to describe what happens save in analytic terms. We speak of some sound and think of that which, as we say, "produces it. But it may in turn produce a shock which makes an animal visibly 'start' and 'startles' him with effects which probably reverberate throughout his whole bodily and mental system. Such a shock falls under the heading of 'any mode of experience'; and it seems that it may be 'associated with any other concurrent mode of experience'.

In some of Blackie's successors I tried this experiment. Take a chick that goes with avidity for juicy maggots. Just as he nears one (the only one there) and before he seizes it, fire (out of sight) a toy pistol with small detonating cap. He starts and jumps aside. As he does so, remove the maggot. Repeat this little game on several occasions, letting him see no maggots between-whiles. Then 'cease firing', and see what happens. I am not quite satisfied with the results. The method of experiment is somewhat crude, and rather tricky, requiring careful timing. But two or three of my birds on subsequent occasions shied at sight of maggots and did not eat them, though I no longer fired a shot.

I say that the experiment requires careful timing. The chick lives forward from 'this' to 'that' in current experience. But often 'this' and 'that' are strictly concurrent, or perhaps alternate in order, so that association



may run either way. In the child, for example, he may have visual fore-experience on touch; tactual fore-experience at sight; and in either case his behaviour will be that which is adjunct to the fore-experience. So there is manipulation at sight; eye-focussing on touch—both ways.

Now my impression was that it was no use firing *after*—even just after—the maggot was seized. But such an impression should be endorsed by experiment *ad hoc*. Mr. G. C. Grindley has devised a way of putting this moot question to the test and reported progress in the *British Journal of Psychology* (Gen. Sec., Vol. XVII, January, 1927, p. 211).

In brief, chicks were taught to run round an obstacle and get food when the experimenter tapped. They were then divided into two batches—or three including ‘controls’. The blowing of a horn was then introduced; in the first batch just before tapping; in the second batch just after the food had been seized. In the chicks of the first batch an onward association was soon established. In those of the second batch there was little or no evidence of a reverse association, when the horn was blown *after* the food was taken.

Instead of the sound of a horn with positive effect, electric shocks were introduced with negative or deterrent effect. Here, too, the association was onward and not reverse.

It seems, then, that we must take the statement that ‘this’ and ‘that’ are ‘concurrent’ subject to some such qualification as ‘in the course of living forward’. One must not expect rewards or punishment given some time after behaviour to have association effect, endorsing or deterrent, on the subsequent course of that form of behaviour. I speak, of course, with reference to the unreflective stage of mental development. At the reflective stage there is more than associative revival.

§ 6

In accordance with the point of view I have sought to open up, association is that mode of mental organization which characterizes the life of perception and gives increasing richness and variety to that life. From this point of view associative organization stands midway between a precedent and a subsequent mode of organization.

In so far as behaviour is the observable expression of co-related organization in body and mind, its three stages are instinctive, intelligent, and rational (conduct). And with them are co-related three stages of mental organization: percipient, perceptive, and reflective. Association, as an affair of mind, characterizes the perceptive stage. Hence, associative organization stands midway between reflective organization on the one hand and percipient organization on the other hand.

No doubt this restriction of the range of application of the word 'association' is a matter of definition, arbitrary if you like. That is what I wish to make clear. And no doubt it runs counter to much traditional usage when the word was prominently in vogue. That I do not deny. But the restriction I suggest is at least in line with much criticism of this usage. You are attempting, it was said, to explain the higher process of thought in terms of some lower process which involves no thought. Here I agree. It goes far, as I put it, to annul the distinction between reflective and unreflective procedure.

This on the one hand. Then on the other hand I may be reminded that, on my own showing, there is from the very first, in Blackie's instinctive behaviour, association of the look of a thing with the act of pecking; of the taste of the thing with swallowing or with ejection.

I do not deny that this instinctive *connection* may be, and sometimes is, called association. I submit,

however, that it confuses matters so to call it. It goes far to annul the distinction between instinctive and intelligent behaviour.

And so I venture to use the word 'association' in suchwise as to preserve a distinction between that which is thus named and the 'more than' of reflective procedure and the 'less than' in the mental concomitant of instinctive behaviour.

## CHAPTER X

### *Trial and Error*

#### § 1

A good deal has been written on 'the method of trial and error' in animal life. And since much of it has rather a contentious flavour, one may ask to begin with: What are the observable facts which it purports to describe?

Some instance may be given; for example, the way in which a white rat behaves when he is said to 'learn' how to 'run a maze' with a bit of toasted cheese as his objective and his reward. The maze is so arranged that there are a number of alternative paths—straight on, to left, or to right. Some of them are open with through passage; others are closed as blind culs-de-sac. How does he get to the cheese along the one continuously open path? Observe and record. He learns through behaviour. He learns by *trial* of each path in turn. At first he makes many *errors* and often repeats them. But at last he runs quickly without pause or hesitation, turning this way and that, along the devious path to his goal.

Here some Gentle Reader who is a stickler for the nice use of words may enter a word of protest. 'There seems, he may say, to be little or no 'method' in this procedure—method in the proper sense of devising a plan to compass an end in view and straightway carrying it into execution. There seems to be little or no 'trial' in the sense of deliberately putting such a plan to the test to see if it will work. There seems to be little or

no 'error' in the sense of recognizing that, on trial, some line of action does not work and must therefore be abandoned. It seems, he may add, that the so-called 'method' is a bit of somewhat complicated and rather bungling haphazardry; that so-called 'trial' is aimless running along any path that is open to him till he finds that it ends blindly; that so-called 'error' is no more than failure.

If this be said, does it not raise the question: How should the behaviour which is observed and recorded be *interpreted* in terms of mental procedure on the rat's part? And it is just here—not in the record of facts—that controversy arises.

One must, I think, when one goes beyond plain-tale description, take a rather picturesque expression as one finds it in current use, and then ask: Does it not cover two different modes of mental procedure? I submit that it does, or at any rate may do so. I submit that we should distinguish a higher reflective trial and error from a lower unreflective trial and error.

Since we are reflective folk we naturally start with the higher and work our way down to that which is said to be lower, harbouring perhaps grave suspicions that what is spoken of as 'lower' differs from that which is called 'higher' only in so far as it is less fully developed.

Let us glance at such fairly advanced human procedure as may fairly be included under trial and error. In his arresting little book on *How we Think* Professor Dewey contends that what I call reflective procedure is always elicited when we are faced by a difficulty or problem and leads to its solution. The difficulty may, however, at first be so vague as to be felt merely as an indefinite something that in some way hinders progress. So the first reflective step is to locate the difficulty and see what it is and how it hinders progress. Then there

comes, or there is in some way brought to mind, a way out of the difficulty. This is more clearly focussed, turned over reflectively, and further elaborated. It takes form as a plan of action. Here is a method by which the difficulty may be overcome. Will it work? Submit it to trial; put it to the test as a means to the end in view. It succeeds or it fails, with satisfaction or disappointment. If it succeeds, well and good. If it fails, there was error in this method. Another plan comes or is brought to mind; this in turn is submitted to the test of trial; errors which have led to failure are recognized as such and as such are henceforth abandoned.

So long as some such scheme as this is not taken too 'formally', it serves to illustrate a method of reflective procedure under trial and error. Central, I submit, is that which in the first chapter (p. 7) and elsewhere [*L.M.S.*, Ch. VII] I have spoken of as a fore-plan of action. It is a fore-plan *in* mind and a fore-plan *of* action. It enables one in practical affairs to take the course of success under circumstances in some measure unfamiliar and yet recognized as in some measure similar. As fore-plan it looks well ahead in anticipation of a future laid out in a reflective time-plan. It thus differs from fore-experience which is tied to the present as that which William James spoke of as a 'fringe of futurity'. I submit that in unreflective trial and error there is no more than fore-experience, whereas in reflective trial and error there is fore-plan also. Unreflective trial and error, a long and tedious process, is superseded by one which, through that which Dr. Köhler calls 'insight' (p. 46), renders further progress swifter and surer.

Fore-plan with insight emerge only at a higher stage of mental organization than that which suffices for unreflective trial and error. At this higher stage of mental organization there is rational conduct as dis-

tinguished from intelligent behaviour. But with fore-plan and insight there emerges also, as I think, 'self in the picture'. The level of mentality which is incipiently reflective is, I believe, incipiently self-conscious. So far as I can rely on first-hand experience, when I am faced by a difficulty, realized as such, it is a difficulty primarily for *me*. To surmount it is *my* end in view. If when a fore-plan comes to mind I anticipate success on trial, it is a successful 'me' I look forward to. Should it be said that this is only so when I think about what I am doing, I ask: Can I act reflectively *without* thinking of what I am doing? If I do not think of what I do and am going to do, am I not behaving unreflectively?

What, then, about the rat when he is 'learning to run a maze'? He has a bit of cheese as his objective. But is getting it his *reflective* end in view? Does he think of himself as presently eating it? After so many failures on this path and on that, he gets it. Does he reflectively realize that through repeated trials and a diminishing number of errors he has discovered the right method of procedure as a means by which his end in view will be attained?

Who can say with confidence that he does or does not? It depends on the level of mentality one imputes to the rat. And all that one has to go on is the behaviour one observes and records. None the less the record of his behaviour, as contrasted, for example, with that of an ape 'in face of a difficulty', may in some measure justify a belief that in his case trial and error is unreflective only.

## § 2

Our aim is to interpret animal behaviour in terms of mind-story. But it is always an imputed mind-story. On this understanding the question before us

is: Shall we impute to this or that animal unreflective procedure only or reflective procedure also?

It is under experimental conditions where one can observe and record the animal's behaviour on a series of occasions that an answer to this question is most likely to be found. It is pretty clear that one must so arrange matters that there shall be on the part of the animal some need, some want, some desire, which shall play a relational part in the proceedings. This we must impute as part of the mental organization of the mind, co-related with the current poise of physiological organization in the body. In many experimental observations this is, broadly speaking, food-hunger, the presence of which we impute on observing the animal's behaviour on sight of, or on smell of, food. In so far as this is already intelligent, like Blackie's behaviour towards 'attractive' maggots, it carries, for me, the further imputation of *fore-taste*. So we may say: If the animal does not want to get the food—maggot, cheese, banana, as the case may be—he will not so behave as to get it.

The experimenter then places obstacles in the path of his getting it. The animal is in some way prevented from getting what he wants. He cannot get it in the customary and habitual straightforward way. He must get it by some more or less roundabout way. How, then, does he behave? He 'tries' (unreflectively) all the modes of behaving which fall within his repertory of behaviour. So the experimenter arranges matters in suchwise that some one of these modes of behaving enables the animal to get what he wants. He may then go further and so arrange matters that to get what he wants the animal must behave in two, three, or more different ways in due order.

This is well illustrated by Professor Thorndike's oft-quoted experiments, for example, on cats in a cage.



The cat wants to 'escape from confinement' and he wants a nice bit of fish outside. He does everything that falls within a cat's nature to do. "For eight or ten minutes it will claw, and bite, and squeeze incessantly. . . . The cat that is clawing all over the box in her impulsive struggle will probably claw the string, or loop, or button so as to open the door. . . . After many trials the cat will, when put in the box, immediately claw the button or loop in a definite way. . . . Starting, then, with its store of instinctive impulses, the cat hits upon the successful movement, and gradually associates it with the sense-impression of the interior of the box until the connection is perfect, so that it performs the act as soon as confronted with the sense-impression."

Among other modes of behaving on the part of a cat is licking its fur or scratching itself. When the cat does this the experimenter, by touching a button, opens the door. "Associations between licking or scratching and escape are established, and there was a noticeable tendency to diminish the act until it became a mere vestige of a lick or a scratch."

If we take the rat in the maze and the cat in the cage as instances; and if we dig out from a very extensive literature a score of other instances; it seems that in face of an obstacle any intelligent animal, through such behaviour as falls within his capacity, may hit on the successful act by which he can get what he wants; and that, if he hits on it several times, there is increasing probability that he will thus act next time, until he always acts thus every time.

Suppose that on the first occasion the animal in the course of acting in several different ways stumbles on success by mere chance, whereas on some later occasion he is straightway successful, and thereafter never fails; one may infer that there is some gradual and progressive

change in his organization; and from the mind-story point of view one may attribute this to associative organization with (as I believe) some mode or modes of fore-experience brought to mind under revival. Such statistical records as Professor Thorndike and others have furnished, and their treatment in terms of probability, lend support to the hypothesis that the procedure of the animal exemplifies unreflective trial and error.

But the animal may be faced by obstacles which can only be overcome by a serial chain of acts performed in right order. The more intelligent the animal, the longer and more complicated is the chain of obstacles he can tackle. By so arranging matters as to accord with the kinds of behaviour natural to this and that kind of animal, the experimenter increases the 'difficulty of the problem' until it lies beyond the wit of the animal to solve it, save on rare occasions where he stumbles on success to be followed on later occasions by failure. It is rather a fascinating game and, if well played, the animal seems to like it, so long as he sometimes gets what he wants. But, even so, such successes as are scored seem still to be interpretable as examples of unreflective trial and error under the establishment of associative organization.

### § 3

Complicated as may be the performance in detail, the running of a maze by a rat is in this sense simple; in that, though there are many alternative paths, some open and some blind, there is predominantly one form of behaviour—running along until he gets what he wants—and one kind of obstacle in each blind alley. But it is difficult to say what form associative revival takes. It seems that a rat can do the trick when he is blindfolded. And one factor seems to be that running

*just so far* may be the associative 'clue' to turning, let us say, to the left. If the distance be changed he still slews round to the left at the customary length of run. This may imply fore-experience based on revival of what he has been wont to do, similar to that of Ginger at the ledge (p. 160). And may one not have some first-hand experience of what this feels like? When, for example, at night I go down a dark corridor, having got so far I reach out my hand for the electric switch. No doubt this is partly reflective. But I think there is an underlying unreflective factor. A blind pupil whom I questioned on the matter said concisely: "Of course; *we* know all about that."

Let me now ask leave to proceed on lines of *supposal*; supposal of what the rat would do if he be unreflective only; and supposal of what he might do if he were reflective also. He has, we may assume, learnt to run 'this' maze. He has kept on straight ahead; obstacle; failure. He has turned down this path; obstacle; failure—down that path; open way; success. And so on a dozen times or more. It has been a long and tedious business; but he gets there. He has been put through his paces again, then again, and many more agains. Progressively with fluctuating records there are fewer 'errors'. At last there are none. He has learnt to run *this* maze.

Put him now into another maze with different blind alleys and open paths. He has to begin afresh. He has through 'trial and error' to learn how to run *that* maze, perhaps rather more quickly in so far as there is something common to this maze and that. And so on with half a score of different mazes.

Now suppose that the experimenter builds half a dozen mazes, differing much in detail, but all to one plan, which he might thus put into words: After starting, take the second turning to the left; then the second

turning to the right, and so on alternating second to left and second to right, till you get there. If at some stage of his maze-running the rat 'hit upon' this method of procedure he might negotiate *any* maze built to this plan however much it differed in details of construction. He would proceed on a fore-plan of action. His procedure would imply not only associative revival but reflective 'insight'.

A little more supposal. Build another set of mazes to a different plan—say alternating first to right, then second to left, and so on. Let cheese be the objective in 'this' set; something equally tasty and redolent the objective in 'that' set. If our rat, on sniffing this, proceed on this fore-plan of action, and, on sniffing that, proceed on that fore-plan, may one not infer that such procedure, though it includes associative revival, affords presumptive evidence that this supposed rat has attained to the status of an animal capable of reflection.

There might still be opportunity for trial and error; but it would be of the reflective kind. Under the supposed conditions he has learnt two plans, this and that. Suppose now a third kind of food is given as the objective. He would have to learn by which of these two plans it could be obtained. He would probably pass through a phase of: This or that plan; but which? One or two trials, however, at the outset of performance, would suffice to decide which of them was the right one. There would be no need to carry through the whole performance from beginning to end.

My aim in invoking supposal is to show how a reflective rat might act, and the kind of evidence which would lead me to believe that he does attain to the level of reflective procedure. But so far as I know there is as yet no such evidence in the case of the rat. And so far as I know there is no such evidence in the case

of any animal until we bring the anthropoid apes into the field of experimental inquiry.

I have already (p. 85) indicated the nature of some of this evidence. Let me recall Professor Yerkes' finding in the case of Julius the orang-utan. For a long while—some 290 'settings' in one series of observations—there seemed to be no more than unreflective trial and error under associative revival. But then there came a marked change. He seemed suddenly to hit upon a fore-plan of action which enabled him to deal effectively in one way with differing situations (settings) in all of which there was relational similarity. Further work is in progress. The importance of considering (under *Gestalt* or some other name) the objective situation *as a whole* in all such experiments is more and more clearly realized.

There seem, then, good grounds for the belief that apes rise to a higher level of mentality than any other animals. Not all that Julius or Chica does can adequately be interpreted in terms of unreflective trial and error only. There is more than associative revival. There is in them the 'dawn of reason' as there is in Blackie the 'dawn of intelligence'. There is, incipiently, at least, reflective anticipation; there is its twin sister, retrospective memory; there is probably self in the picture.

It is, however, unreflective trial and error with which I deal chiefly in this chapter. This characterizes the animal mind throughout the whole range of the life of perception. It characterizes all intelligent behaviour.

This only need here be added. As at present advised, I discern no sufficient evidence of what I call fore-plans of action, or of what, as I understand, Professor Köhler means by 'insight', in any animals zoologically lower than the anthropoid apes. But such evidence may be forthcoming for some monkeys, or for other animals,

next year or within the next decade.' If so I, for one, should rejoice at this increase of our knowledge of the animal mind. But if so, the distinction between reflective and unreflective procedure would remain unaffected. It is this distinction—this new departure, wherever it arises—which seems to me to be of cardinal importance for an evolutionary interpretation of the natural course of mental development.

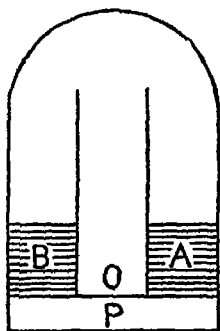
## § 4

The outcome of the process of trial and error in animal life is the establishment of some habitual form of behaviour, or, in brief, some habit. Let us here understand by the word 'habit' a form of behaviour which is learnt or acquired by the individual animal in the course of his own life, as distinguished from a form of behaviour which is instinctive, unlearnt, and prescribed under inherited organization. In the chick, pecking is instinctive; the avoidance of medicated rice-grains is acquired. In this case two or three 'trials', or it may be only one, suffices. Though it puts some strain on customary usage to speak of a habit in this case—to say that a habit may be learnt by doing something once only (as a limiting instance)—allow me to do so in this technical sense. Then there must be at least one occasion on which a habit is individually acquired.

Bearing this in mind, it need not trouble us just now. All but the simplest habits require several, perhaps many, occasions for their establishment. Under experimental conditions one can ascertain how many are required—in the statistical sense of 'so many'—'on the average', as we commonly say.

It is well to take for consideration some pretty definite habit, neither too simple nor too complex. Professor

McDougall gives us just what we want. It brings us back to the rat. Let me cite from a recent paper of his<sup>1</sup> a statement (with figure) which clearly describes the conditions of the experimental inquiry.



"The rat to be trained is repeatedly placed in the water [of a tank] at O. He can escape from the water to the platform P only by climbing one of the two gangways, A and B. On each occasion one of the gangways is brightly illuminated from behind and is so wired that the rat, as he emerges from the water on to the gangway, receives a secondary interrupted current through his feet. After each immersion both the shocking and the illuminating current are switched over to the other gangway. Each rat is immersed at O six times on each day of training (a day occasionally being omitted) until he makes twelve successive escapes without error. The total number of occasions on which the rat has taken the illuminated gangway and received the shock is accepted as the inverse measure of his facility in mastering the task or solving the problem."

Under these conditions, and after so many trials, the rat learns the trick of the tank. To interpret this in mind-story I believe that associative revival (unreflective)

<sup>1</sup> "Second Report on a Lamarckian Experiment," *Brit. Journ. of Psych.* (Gen. Sec.), January, 1930.

suffices. I should impute to the rat fore-experience of shock on sight of the illuminated gangway, closely analogous to Blackie's fore-taste on sight of a nasty object, and no more. For Mr. McDougall such an interpretation would *not* suffice. Let us, then, keep to the plain tale of observable behaviour.

Now the chief interest, and the great value, of Mr. McDougall's admirable investigation lies in this. He has dealt with rats of a series of generations up to the twenty-third. And he finds that members of the last generation learn to do the trick much more quickly than members of earlier generations; that there is increasing facility of performance in each successive generation.

Due care was taken to exclude selection of the rats under observation. I cannot here enter into the details which are clearly set forth in Mr. McDougall's Reports. So far as I can judge, the evidence he adduces in favour of increasing facility goes far to carry conviction. Let us then provisionally assume that the plain-tale case is proven. Let us accept as a 'fact' that from the fourteenth to the twenty-third generation the average number of errors per rat decreases, say, from eighty to twenty-five. Then this marked increase of facility calls for interpretation in terms of organization. From the mind-story point of view it is such associative organization as provides for more ready revival in the course of successive generations. If you ask how is this provision effected I must frankly confess that I do not know.

That, however, does not preclude my loyal acceptance of the facts. What, then, are the facts? Let us say that many occasions of error are reduced to few. Carry this further, under supposal. It may be supposed that few occasions are reduced to one. There would still be associative revival. For associative revival there must at least be one occasion. If not at least one the



observed behaviour would no longer be acquired in the course of individual life but would be unlearned and prescribed under inherited organization.

Of the inheritance of an acquired habit in *this* sense there is as yet no convincing evidence. This is, however, a debatable and much-debated matter. So let me say that there is no such evidence as carries conviction to all those who have made this matter a focus of special inquiry.

And from the body-story point of view this matter has for long been a focus of special inquiry. Apart from the general question: Are acquired characters inherited? the more special question may now be thus formulated: Are what are now called 'conditioned responses' inherited? Dr. Pavlov, as I understand, sees as yet no convincing evidence that they are inherited.

There I must leave this very contentious matter *sub judice*. Mr. McDougall has approached it primarily from the standpoint of a psychologist. I regard the outcome of his investigation as of very great value. It throws much light on the inheritance, in some sense, of mental organization. And if from the conditions of the case it deals only with inherited facility of associative revival under trial and error; if it still leaves unsolved the further question whether a first-occasion response is in some way the offspring of associative revival in the parents; our thanks are due to him for a noteworthy contribution to the solution of a vexed problem. It may be that some rat of the forty-sixth or the ninety-second generation will avoid the illuminated gangway at sight on the first occasion of immersion without receiving a single shock. Then it will have been shown that his procedure does not exemplify associative and unreflective trial and error.

## § 5

The outcome of trial and error is a difference of response to this and to that, from which one may infer discrimination. The rat, one may say, learns to discriminate the dim gangway from that which is brightly illuminated; the chick learns to discriminate a nice maggot from a nasty cinnabar caterpillar. One may say that all intelligent behaviour implies such discrimination.

But, since one is forced by poverty of language to use this, or some other word, one should, I think, carefully distinguish reflective from unreflective discrimination. In reflective discrimination it is realized as a means to the attainment of an end in view—is thought of as contributory to overcoming the located difficulty. But where the discrimination is unreflective, it is interpretable in terms of associative organization, of which the observed difference of response is the outward and visible sign.

Incidental to trial and error is that which leads us to impute hesitation. Of this the outward and visible sign is a twitching of behaviour now this way and then that, or such arrest of behaviour either way as to lead one to say: He cannot make up his mind which of the two courses to take; or, He is unable to come to a definite decision. In saying this, or the like, one implies that the procedure is reflective. But it may be less than this. It may be unreflective only. It is, I think, in all cases the sign of organization in progress and as yet incomplete. When organization is fully developed there is no longer 'hesitation'; there is definite action.

Now it is you or I, the rat or the chick, who discriminates, hesitates, decides, or chooses, and enjoys awareness in so doing. We are here dealing with subjective

attitudes, though there is of course also reference to the objective situation.

Mr. McDougall lays stress on these mental attitudes on the part of the rats in the tank. And I think that all those who are in close touch with the intelligent behaviour of animals under experimental conditions will impute these and other such mental attitudes, though they may interpret them differently. Some impute reflective mentality to the rat; some do not. Mr. McDougall reads more into the mind of the intelligent animal than I do.

My aim, however, is not to emphasize this difference of opinion. My aim is to express my belief that, however we name them, and whatever may be the level of mentality they betoken, such mental attitudes there are; that they are constituent parts of the rat's enjoyment as a whole; and that this whole is more than the sum of its parts.

Let me now revert to the plain-tale record of observation. What one observes under trial and error is the establishment of some new routine of behaviour. It is a new routine in an unfamiliar situation.

Under old routine, already established, the animal has learnt to deal successfully with all familiar situations. But from time to time he lives forward into, or the experimenter leads him into, unfamiliar situations. What then happens? He 'tries', or, as Mr. Alexander might say, there are 'wrung out of him', all the relevant modes of behaviour in his repertory. He does this, then that, then something else—anything which the circumstances elicit under routine thus far established.

But how comes the new out of bits of the old pieced together or strung together? I take it that *au fond* there are two answers: one 'mechanical', the other 'organic'. If we regard routine in familiar situations

as merely a mechanical arrangement of events, then the new routine in an unfamiliar situation may be regarded as a *no less mechanical re-arrangement of some of these events*. The rat's performance in an unfamiliar situation is thus no more than the algebraical sum of the modes of behaviour already in being through action in familiar situations. In the running of a maze by a rat this, that, and the other response with reference to an objective situation, are omitted as 'errors'. There remain only the open-way responses.

That in a measure may be true enough. There are mechanical factors to be reckoned with. There is an algebraical sum of responses. But is that all? Are there no kinds or modes of effective relatedness other than those which we call 'mechanical' in some sense of this much-abused word? In what way is this word to be defined when it is said that So-and-so interprets all mental procedure 'on mechanical principles'?

What do we seek to interpret? Is it not the growing experience and fore-experience which, rightly or wrongly, we impute to the rat? It is mind-story with which we are concerned, however closely this may be connected with a body-story. And in mind-story the rat that has learnt, through unreflective trial and error, to run the maze, or to climb the dim gangway, is no longer the rat that aforesaid he was. He is now a maze-running rat, or a tank-rat. There is not only an accumulation of experiences; there is organization in experience; organization in reference to the objective situation; organization in modes of subjective awareness—in mental attitudes. And, as in any instance of organization from the lowest to the highest, so in this instance; there is more in the whole than is given in the mere sum of the parts.

But all that the rat does can, I believe, be interpreted in terms of unreflective trial and error. Associative

revival can take him far along the path of intelligence. But to carry some animal to a higher level of mentality a new mode of reflective organization must supervene in the natural course of events.

## CHAPTER XI

### *Memory*

#### § 1

The whole problem of memory is so complicated; the word 'memory' is used in so many senses, or at least with so many different shades of meaning; underlying cross-currents of philosophical conviction so influence the course of discussion; that it is no easy task to comb out the tangle as best one can.

And part of the trouble is that in picturesque forms of literary expression two or three shades of meaning may be interwoven within one paragraph. Let me illustrate with a touch of piquant exaggeration by combining in one sentence and under one metaphor three meanings. "I send my good butler memory to fetch up from the cellar of my memory a sample of the choicest vintage of my memories stored therein." That sort of thing, under suitable literary expansion, with a glance at the butler drawing the cork and so forth, is all right in its way. It is much more consonant with approved table talk than to say: "I recall a good joke."

Here the cellar stands for a receptacle-notion of memory in which are stored and retained for future use certain contents—ideas, images, or in one word 'memories'. The butler represents the process of remembering or recollecting.

This receptacle-notion of memory is in line with a box-notion of space wherein lie all the possible positions which may or may not be occupied by things; and a stream-notion of time which contains all events in their

onward flow. Hence, it is commonly said that things are 'in space' and events are 'in time'. Nowadays, however, we are bidden to substitute for a box-notion of space and a stream-notion of time a frame-notion of space-time. Within this frame *as a construct of thought* fall all those spatial and temporal relations of events, and of things as clusters of events, which are disclosed to the physicist under observation and experiment.

But so long as we restrict our attention to physical events, there is no provision within this space-time frame for those relations which we speak of as conscious. If Blackie be within this frame all those bodily actions which we include under his behaviour are susceptible of treatment in terms of physical space-time. If, however, we impute to Blackie fore-taste or any other form of fore-experience, this is something other than is included in a space-time frame which suffices for physical treatment. It seems, therefore, that we must supplement the physical space-time with a mental space-time frame. And under suitable definition this might be called a memory-frame.

Here the difficulty is to reach some common consent as to a suitable definition. One may ask, for example: Is fore-experience to be included under the heading of Memory? Some may say, Yes; others may say, No. Those who say, Yes, regard *retention* as the characterizing feature of memory. In the picturesque language of the receptacle-notion it might be said that some mode of experience, say taste, is so stored and retained as to be revived or to reappear on a subsequent occasion as fore-taste. Those who say, No, place memory at a higher level of mental development than that at which there is presumptive evidence of retention. For them the characterizing feature of memory is retrospective reference. This no doubt implies revival, as revival implies retention; but retrospective reference is something more than revival; revival something more than retention.

It is partly on differences in definition that divergence in theory depends. How wide this divergence may be is well seen in Professor Edgell's admirable little book on *Theories of Memory* (1924). The first chapter deals with Retention as a Biological Conception; the last with Retentiveness as a Psychological Conception. In between we have a discussion of Behaviourism; an historical review of the treatment of the memory problem by English writers; a survey of the teachings of some representative New Realists; and an account of the influence of M. Bergson's thought on all those who are wrestling with the difficult problem before us.

We are here chiefly concerned with Miss Edgell's port of embarkation and port of arrival. She starts from the biological concept of retention (in body-story), and she ends with the psychological concept of retentiveness (in mind-story). Let us accept this verbal distinction. Then we may say that 'retention' is a matter of physiological organization; 'retentiveness' a matter of mental organization. Then Miss Edgell, as I understand, contends that no adequate interpretation of mental organization can be rendered in terms of a biological or behaviouristic concept of retention as a mode of physiological organization. Here I agree so long as we keep to strictly relational treatment. Closely as they are co-related, mental relations differ in kind from physical or physiological relations. But Miss Edgell further contends that 'memory-images' differ fundamentally in kind from 'sense-impressions'. If this means that fore-taste differs in kind from taste, I cannot agree; for both are of the mental kind. But if it means that, under 'kind', we should distinguish between 'renewal' and 'revival',—renewal of taste under repeated stimulation, revival as fore-taste without receptor stimulation—I fully agree. To put the matter baldly and tersely, a thousand renewals



of taste do not bring us within sight of one revival as fore-taste.

Here I think we agree, but with underlying disagreement. I should say: Fore-experience is one of those new departures in mental development which I speak of as emergent. Miss Edgell, however, has (if I may so put it) no use for emergence. Not emergence (she would, I think, say), but the creative activity of mind. In any case she does say: "We fail to understand how 'revival' can emerge from retention conceived as a purely physiological process of renewal." *Et moi aussi*. So here too we are in agreement.

And when in her concluding chapter Miss Edgell says that "memory is cognition of something known before"; when she says: "The form of memory which is most truly knowledge of the past is personal reminiscence"; I, for one, say: Here we have a characterizing feature of memory of which each of us has first-hand experience at the reflective level of mental development. Let us take this, rather than revival or the retentiveness in mental organization which revival implies, as our port of embarkation. Then we can ask: Have we good grounds for imputing this retrospective reference, as I call it, to Chica, to Tony, to Blackie? We must reverse the evolutionary order. We must work back from the higher to the lower. But can we do otherwise if, as I contend, the only avenue of approach to the animal mind is the hazardous path of imputation based on first-hand experience?

## § 2

Permit me now to distinguish for the purpose in hand 'memory in a general sense' from 'memory in a special sense'. Under memory in a general sense I include Retrospection; Remembrance; and Retentiveness. By

retentiveness I mean the abiding persistence of mental organization at any level of mentality—percipient, perceptive, or reflective. This, I believe, is always correlated with retention as the abiding persistence of bodily organization. But this I should not include under memory even in a general sense. I should restrict the use of the word 'memory' (in any sense) to that which I speak of as mind-story.

By remembrance I mean the coming to mind under associative revival of that which is remembered with awareness in remembering. On hearing Onslow's quintette (p. 155), there was for me remembrance, with the associative revival of monkeys as 'memory images'. This led to retrospection with reminiscence of an incident in my boyhood. There was some effort and endeavour on my part. And this I regard as a distinguishing feature of recollection. Remembrance just comes; that which we recollect is, as Locke says, "sought after by the mind and with pain and endeavour found."

Memory in this general sense, though it includes reference to what we speak of as the past, may include also reference to the future. It includes, for example, all modes of fore-experience. And if Blackie has foretaste we naturally ask: What is the good of it? The answer is: For what follows in behaviour. More comprehensively we say that a good memory is of value for further action, and, in us reflective folk, for further thought.

In a special sense memory may be, and often is, restricted to retrospective reference. In this sense memory looks only to the past; while its twin sister, anticipation, sometimes spoken of as 'inverted memory', looks forward to the future. It is in this sense that Professor Thorndike and others have urged that animals have no memory.

One must emphasize *in this sense*. Few would deny

to animals retentive memory in the general sense. It is exemplified in Blackie on the first day of his free life. It is exemplified at fuller length in this story of a gull, which is given by a correspondent to *The Times* (April 2, 1930). "Some years ago the inhabitants of a cottage in Sark succeeded in taming a herring gull to an unusual degree. It came very often for food at all times of the year, pattering about inside the cottage as well as around the garden. In winter, when doors and windows were shut, it tapped imperiously at the window. On being let in it made for the hearth and warmed itself at the fire between the cat and dog, who from long habit made no attempt to molest it. My informant, an eye-witness of this eccentric behaviour in a gull, was told that the bird had been coming to the cottage for 20 years."

I cite this story because it is the kind of plain tale which is adduced as evidence of 'memory in animals'. And I ask: Is there in such cases evidence of retrospective reference? This, no doubt, one *may* impute. But if so, what does one impute? Is it not looking back on those past occasions in the individual life-history when tapping on the window secured entrance and warmth at the hearth? Does not this—water it down as you will—assume reminiscence on the part of the gull?

We must therefore consider what reminiscence implies. We may find that it implies more than is requisite for remembrance; that it implies some measure of reflective procedure. We shall have, however, to turn to first-hand experience—to *our* memory in the general and in the special sense. In your memory and mine there are all three factors, retrospection, remembrance, and retentiveness.

In what we commonly speak of as a retentive memory the emphasis is on remembrance, though there is retrospection also. Now without going so far as to say that there is no connection between retentiveness and intel-

lectual capacity—that would run counter to the organic principle—it is in place here to take note of those whose intellectual capacity, good but not conspicuously good, may go with superlative retentiveness. Such an one I have known; one who after reading half a dozen pages could close the book and recite it all ‘word perfect’; one who could read to himself a long passage while I read another passage aloud, and then recite *either*, complete in substance, but neither word-perfect (probably from fluctuation of attention); one who, as member of an Essay Club, reviewed a book he had not opened for twenty years, gave, he told me, the plot in detail, named and commented on subordinate characters, and quoted longish speeches with substantial accuracy.

“What a gift!” I said on one of the occasions on which, through his courtesy, I put him to the test. “Yes, of a sort,” he replied, “but, alas! I have cause to regret so lavish a gift.” “How so?” “Well; I think of my long-ago school-days. Euclid, for example. I had only to read through a proposition and repeat it on demand. Understand it? No. That was not my *métier*. I could get along passably well without understanding it.”

Of course, as transpired in further conversation, this was picturesque exaggeration. My friend was intellectually no fool. What he wished to emphasize was that, in the matter of Euclid, for example (under the old-fashioned school regime), he could so safely rely on sheer retentiveness and remembrance without effort, that, to keep his place in class, he need not worry over the geometrical argument. That was quite a different story. “My memory,” he said, “illustrates what I understand Huxley to mean by conscious automatism. I am so built as to remember without effort and to learn without effort.”

Others who can in due course remember without effort

learn slowly and with difficulty. Charles Brandram, who could recite any one of half a dozen or more of Shakespeare's plays, told me that in learning he had to go over each passage again and again and yet again, little and often, day by day, before 'it was part of him'. But then he never forgot it. "Whether it comes quickly or slowly," he said, "the mere remembering is quite subsidiary in my line of business. It is the rendering, not the remembering, that counts."

My aim in this section has been to suggest that memory as remembrance is, even in us, mainly at the unreflective level of our mentality, although in us, it is, so to speak, the platform on which memory in the more special sense of retrospective reference is reared. This platform analogy—like any other mechanical notion—no doubt limps badly, since unreflective remembrance is caught up with, and is organic to, the reflective procedure in retrospective reference.

### § 3

I said that memory, in the special sense of retrospective reference, and anticipation, in like sense as prospective reference, are twin sisters. In memory one turns to the past; in anticipation one faces the future. These twin sisters come to the birth, as I believe, when the stage of reflection is reached in the course of mental development—and not till then. To the child they may be imputed when he attains the age of about  $2\frac{1}{2}$  years. My memory goes thus far back with respect to a definite incident which my parents could confirm and date; and this took the form of that which I speak of as 'self in the picture'. It does not go further back than that because, as I think, before that, there was as yet no memory-picture to go back to. Not until the reflective stage of mental development is reached is there any dawning concept of self. Such is my belief.

I find it, however, very difficult to render clear what I mean by 'self in the picture'. Let me try. If someone ask me at lunch what I did this morning and what I propose to do this afternoon I cannot reply without telling him what I did and propose to do. I visited, let us say, Bosham church. There am I getting out of the motor, walking towards the tower (just as I see it in the print from the Bayeux tapestry with Harold and his men riding by); I enter; I see the Saxon arches; I fly off to Deerhurst, and am there; to Worth, I am there; now I am back in Bosham, looking down on the 'raven' tile, said to mark the site of the coffin which contains the bones of a daughter of Canute; and all the while I am at lunch talking to and looking at the someone who seems rather bored.

That is the kind of thing I mean by 'self in the picture'. It is not only a picture in visual or other imagery; it is also a conceptual picture. There is no image of mind-self; there is a concept of self. And it is pictured, under retrospective reference 'in the past'. Only in the past is there a memory-picture of self; for only to the past is there retrospective reference.

A concept of self in the picture is a characterizing feature of reflective procedure. It marks the self-conscious stage of mental development; the highest of the three stages—sub-conscious, conscious, and self-conscious (p. 58).

But (you may say) this is not the usual meaning of the word 'self-conscious'. As the word is commonly used it means self-centred. In the self-conscious person the 'me' is pictured as the focal centre of the admiring, or perhaps critical, regard *of others*.

This, however, does not imply that self is *out of* the picture; nay, rather that self is too much *in* the picture. But it does imply that other selves are in the picture. This, too, comes at the stage of reflection. And I share

with many the belief that the concept of self and that of other-self, or *alter*, appear on the reflective scene hand in hand. Hence, to revert to Chica, my belief is that when there dawned some reflective reference to herself in the past or in the future, there dawned also reflective reference to Sultan in the past or in the future. Thus should I interpret the 'adornment' behaviour which Dr. Köhler describes in a passage which I have already transcribed (p. 88). Expression on Chica's part here seems to be with the end in view of making an impression on Sultan. If so, to her (but not to the Grebe) I impute reflective procedure. And if so, Chica is in some measure self-conscious in the usual sense of this word.

My aim has been to make clear, if I can, that by 'self' I mean primarily the 'me-self' to which there is reflective reference; and that if there be no reflective reference there is no 'self' in the picture. Such reference to self may be retrospective in memory or prospective in anticipation.

It is under anticipation on Chica's part that I impute to her a fore-plan of action with self in the picture. That means that she has in mind, though she cannot put into words: Thus and thus shall I behave. But she has also in mind: Thus and thus did I behave on like occasions. I impute to her, as representing the higher apes, anticipation with prospective reference and memory with retrospective reference. But if you ask: Does she clearly distinguish the one from the other? I, for one, cannot say more than: I guess that she does not. She may not be able to distinguish one twin from the other. In the practical business of behaviour, however, I think it probable that her eye is to the future. For, after all, that is what matters. She lives forward; and she looks forward to getting the banana. A backward glance to the foregoing niceness of bananas is probably there. But it is the fore-taste of this banana now within sight,

and to be brought within reach under fore-plan, that counts most in her behaviour. And it is noteworthy that all experiments to test the mentality of apes or other animals are arranged with a view to what they *will do*, or fail to do; noteworthy, too, that it is on the behaviour in 'living forward' that all imputation of mind to Chica, or to Tony, or to Blackie, is founded.

## § 4

I understand, says the Gentle Reader, that you do impute reflective memory to Chica. You believe that she does revert to past occasions on which *she* secured a banana by behaving in this way or in that.

Taking your definition of memory 'in a special sense' as retrospection with the self read into the 'picture' of the past, one may be ready to agree with you. But have not your Tony, and even your two-days'-old Blackie, memory in just the same sense? Do not they, too, read themselves into the past when they are behaving with an eye to the future? Can Blackie have 'fore-taste' without any reference to 'taste' on precedent occasions?

There, Gentle Reader, lies the rub. I am ready and willing to admit that Blackie's behaviour *can* be interpreted as implying retrospective reference—that his procedure *may* be reflective; that he *may* have a picture of 'self in the past'. It is an open hypothesis (under imputation) that this is so. None the less I, for one, do not accept this hypothesis, in the case of Blackie, or even in the case of Tony. You ask me: Why not? I reply: Because, in my judgment, all their behaviour can be interpreted on the hypothesis that they are at the unreflective level of mental development, a level at which there is no memory in the sense of retrospective reference to past occasions with self in the picture.

You may still ask whether there are not rather puzzling



difficulties in this 'picture notion' especially in its bearing on the perennial problem of time? Retrospective reference is to events which occurred in the past. If self be in the picture these events occurred within the span of one's own past. Prospective reference is to events which will, or at any rate may, occur in the future. But (it may be said) the past is dead and gone; the future is still unborn; only the present, in some sense, lives onward from the 'no longer' towards the 'not yet'. How can one escape from the living present so as to put oneself back into the dead past, or to leap forward into the unborn future?

If, Gentle Reader, you raise this difficulty, I must not try to evade it.

Let us go back to the receptacle-notion of memory (general sense) in which 'memories' are in some way stored. It is, I think, a picturesque notion, pleasantly redolent of metaphor, which, I take it, most of us entertain in common speech and for literary use. If, on that understanding, you like to speak of a well-stocked memory, with memories (ideas) so deftly pigeon-holed that the happy possessor can lay his hand at once on exactly what he wants without faltering or fumbling, I shall not say you nay. And if, giving further rein to imagination, you like to regard the mind as a storehouse of memories awaiting remembrance under the touch of revival, retaining all the memories bequeathed by its past experience and swelling with new memories at every step of advance, I can attune my ear to the music of your phrases. If, then, you bid me read M. Bergson's philosophical poem on Life as the progressive embodiment of racial memories, I can assure you that I have already done so with pleasure and sincere appreciation of its consummate artistry. But if you ask me whether I accept the receptacle-notion of memory as affording even the semblance of a scientific hypothesis of value

for the relational interpretation of memory, general or special, I must say frankly: No; I do not. Nor am I alone in rejecting any such storage hypothesis. For me, as for Miss Edgell, "it is impossible to conceive how the past can survive in the form of memory-images".

Does it survive in any form save in that of reflective organization? And, even so, if the past be dead and gone, in what sense can it be said to survive? Are not such words as 'survival' and 'revival' conventional symbols in picturesque speech which as applied to the affairs of the mind must not be accepted too literally? I take it that statements which purport to be scientific are meant to be taken literally. But in the affairs of the mind it is hard to express what one wants to say without using language in some measure metaphorical. When I speak of retrospective reference to the past I think I know pretty well what I mean until some worrisome person comes along and asks me what exactly I do mean.

What, then, do I mean? I must take some fairly simple example. Casting about for one which may serve, I remember that I kept an appointment at 11.30 this morning as arranged by telephone yesterday. Here is retrospective reference to the past with 'self in the picture'. But what is this past to which memory has reference? It is, I submit, the backward stretch of a *time-plan* which reflectively came to mind when the appointment came to mind. It is so organic to all such 'past' situations that I may be said to 'carry it in mind'—that is, it is 'part of' my reflective organization. But this time-plan I have in mind *here and now*. This time-plan is *not* past, though it includes the memory of occurrences which have passed—which were but no longer are. My picture of the past, with myself in the picture, is thus 'representative' of the past. My appointment, and my keeping it, bears the mark of the past *in the representative time-plan*.

There are, I submit, two steps which we reflectively cover in one leap. A given memory, such as that of my appointment, is referred to its 'date' in a time-plan; but this time-plan provides for reference to an occurrence which was 'in the past'—the past which is dead and gone. We take these two steps in one leap, and thus 'jump to the conclusion' that the occurrence itself is still there in the past, and that one has only to 'put oneself back in the past' to find it there. It may be so. Many believe that it is so. Among them not a few New Realists. But I find nothing in my first-hand experience which leads *me* to believe that it is so.

Let me now revert to the time when I fixed up the appointment on the telephone. *Then* there was prospective reference to the future 'represented' in the forward stretch of my time-plan. 'Then a future occurrence with myself in the picture—entering the door, sitting in the chiropodist's chair and the rest—was reflectively in view, though it had not yet occurred. And I might have jumped to the conclusion that there it all is in the future—that I should find it there in due course at 11.30 on the morrow morning when the clock-hand and I got there. I did not do so. But I had what I speak of as a picture of what would probably happen with myself in the picture. You must not, however, take the word 'picture' too literally. In the literal sense one can picture neither time nor self. What I mean is a reflective thought-picture.

## § 5

At the reflective level of mental organization memory and its twin sister anticipation, as retrospective and prospective reference, imply a time-plan of events which we label 'past' or 'future'; imply, too, a concept of self (me-self or other-self) which is 'pictured' within this

time-plan. This picture includes one's current enjoyment on some past or future occasion with revival of this enjoyment.

Now I do not say that reflective procedure in us human folk implies no more than this. I say that memory and anticipation in the reflective sense imply not less than this. My theme is the animal mind. So the point for emphasis here is that I think we may justifiably impute some measure of reflective procedure to Chica and her cousins. I regard it as probable, on the evidence, that the anthropoid apes do on occasion have in mind a dawning concept of self, me-self and other-self; that they do picture themselves as having done or experienced this or that awhile since; that they do picture themselves as about to do it again with enjoyment ere long; that they do have thus far an incipient time-plan of events which have occurred and will occur again in like fashion.

But it is probably short-range memory and anticipation at short range. It is probably restricted to some current suite of occasions closely connected with some insistent objective, becoming transformed into a reflective end in view; and with some persistent urge, becoming transformed into reflective endeavour. None the less, I believe it is there.

Much more weighty, however, than my belief is that of Dr. Köhler. He expresses his opinion that "the time in which the chimpanzee lives is limited in past and future". The number of observations, he says, in which any reckoning on a future contingency is recognizable, is small; and he adds, with the emphasis of italics, that the clearest evidence is afforded when the anticipated event is a planned act *of the animal itself*. "In such a case an animal will spend considerable time in preparatory work, as when Sultan labours long to sharpen one end of a wooden board, so that it will afterwards fit into a tube, and he can carry out his aim with the double stick."

Before this Sultan had in the course of playing with bamboo tubes fitted one into the other and thus formed a double stick. Here he gnaws off splinters from a narrow board, just too broad to fit into the opening of the tube. He "bit away wood almost exclusively from *one* end of the board, and even if he took the other end between his teeth for a moment he never gnawed blindly first at one and then at the other".

This brief resumé of one set of observations disclosing successive steps of advance gives a meagre notion of the kind of behaviour which Dr. Köhler records at full length. The chimpanzee spends much time in procedure which is, we are told, 'quite unmistakably preparatory'. "Where such preliminary work, obviously undertaken with a view to the final goal, lasts a long time, but in itself affords no visible approach to that end, there we have the signs of at least some sense of the future." "The word 'future' is here used in its usual sense, so that 'to make a picture of the future' refers to situations lying outside the actually occurring unit or whole of behaviour."

With regard to the past—in like sense of 'a picture of the past'—Sultan again is under observation. He "is sitting alone"—I quote Dr. Köhler—"in a barred space which contains no sticks. Outside, in a homogeneous dry sandy place before his eyes, 1.40 metres away from the bars, I bury a pear some centimetres deep, and I wipe away every trace of the hole by smoothing evenly over the spot and all around it, so that I could not recognize the place myself. Sultan, who at first looks very disappointed, soon begins to play, apparently showing no further interest in what he has seen. When I approach him after about six minutes, he quickly seizes my hand, as if to lead or pull me, but he is repulsed. Nine minutes later, when I again approach, he repeats this at once, and it is now clear that the animal is trying

to drag me to the stick, which is lying outside, some distance from the burying place, and which cannot be reached from the bars. As I will not give in, Sultan stops and keeps quiet until (seventeen minutes later) I come near to him again and he can repeat his attempt. Just half an hour after the beginning of the experiment, while he is busy with something else and not looking out, the stick is put close enough to the bars for him to be just able to reach it with some effort. At first Sultan does not notice this change; but when his glance again happens to fall on the stick, he springs up, pulls it in, runs quickly with it to the bars opposite the burying place, and scrapes the sand away at the exact spot until the pear appears."

Here the evidence is such as to justify the belief, supported by much other evidence, that Sultan had in mind a time-plan to which there was reference, retrospective in memory, prospective in anticipation, with 'self in the picture'—not only Sultan-self but Köhler self. If so, I accept the conclusion of an observer so careful, a psychologist so cautious and so well equipped under scientific method—I may add so organic in his outlook—that chimpanzees show the characterizing features of that 'insight' which betokens the reflective level of mentality.

## § 6

I spoke at the outset of this chapter of the complexity of the memory problem, and of the different shades of meaning which may attach to the word 'memory'. In attempting to comb out the interwoven threads I suggested that one might distinguish three levels of memory if this word be taken in a general sense. They are in descending order Retrospection, Remembrance and Retentiveness.

When we deal with adult human folk retrospection seems to be so organically part of what we commonly mean by memory that I think reference to the past (in some sense) may be regarded as the distinguishing feature of that which I have spoken of as memory in a special sense. Of this, and of the grounds on which a little dose of this may be imputed to apes, I have said as much as my limited space permits.

Let me now turn to retentiveness, jumping from top level to bottom level, but on the understanding that there must be retentiveness at all levels.

Retentiveness in the mind is co-related with retention in the body. But if I am asked: What is retained? I can only reply: Some form of mental organization under retentiveness, co-related with some form of bodily organization under retention. I believe that these two kinds of organization, mental and physical respectively, always go together, in Blackie, or Tony, or Chica for example, and that we can nowise separate one from the other under relational treatment.

The question I am here raising is this: Is there ancestral or racial memory? If so, is it memory as retrospection, memory as remembrance, or memory as retentiveness?

Since I proceed on the method of imputation, and since first-hand experience affords the sole basis of imputation, I must turn to my first-hand experience and ask you to turn to yours. I find nothing that leads me to believe that on any occasion there is retrospective reference on my part to some previous occasion on which my father did the like or had the like experience. I can in a picturesque sense put myself back into *my* past, down to the age of  $2\frac{1}{2}$  years. I cannot put myself back into *his* past on a date when there was no me in my picture of the past; for instance, when, as a boy, he went to Winchester.

Nor do I find anything which leads me to believe that

association of this and that on his part has led to the revival of 'this' on sight or on hearing of 'that' on my part. I do not believe that his remembrance of monkeys on hearing a quintette of Onslow's before my birth would be inherited as associative revival in my case.

If, now, I turn from my first-hand experience to that which I impute to Blackie, I see no grounds for assuming that on the first occasion on which he pecked at a cinabar caterpillar and experienced a nasty taste there was any retrospective reference to that which his ancestors had done or experienced on like occasions; or for assuming that there was, under remembrance, any inherited fore-experience.

No doubt all that I have to go upon is the behaviour I observe. What I find is that Blackie pecks indifferently—that is, at the outset, with no difference that I can detect—at things nice and nasty. I conclude therefore that on this occasion there is no inherited fore-taste. In hundreds of observations on scores of young birds (and the young of other animals) I find nothing to justify the imputation to any one of them, on any first occasion, of any inherited fore-experience of any sort.

We are often told that 'we must admit' that the bird builds its nest with fore-sight and a fore-plan in mind. If fore-plan, then we must assign to a goldfinch mentality, on a level with that of a chimpanzee. But I urge that we are no more bound to admit that there is, on the first occasion of nest-building, fore-experience in the form of fore-sight than that, on the first occasion on which Blackie pecks at a cinabar caterpillar, there is fore-taste.

In that sense of the word 'memory' in which it means associative remembrance with revival there is, I believe, no ancestral memory and no inheritance of memories. And since memory in the sense of retrospective reference is based on and presupposes remembrance, in that sense too there is no ancestral memory.



We must dig down therefore to retentiveness. It is retentiveness in, or continued persistence of, mental organization co-related with analogous retention in, or persistence of, bodily organization. Here, surely, there is racial persistence no less than individual persistence, subject of course to progressive advance of organization in the evolution of the race and in the development of the individual. If this be called memory here surely few will deny racial or ancestral memory to any living organism. It may, however, be said that this is what Miss Edgell speaks of as 'memory as a biological conception'. That is so with respect to bodily organization. But my belief is that with every mode of bodily organization there is co-related a mode of mental organization. This means that every instinctive act on the part of Blackie or another is not only an organic whole in bodily behaviour, but also an organic whole in experience, with multiform percipience, with awareness in behaving, with felt urge, with affective tone suffusing the experience as a whole. There are bodily concomitants for the physiologist and the biologist to interpret: but it is this experience which those whose province it is to study the animal mind seek to interpret as best they can.

Now when an animal behaves instinctively on some first occasion; or (still instinctively) again and again *da capo* on many occasions; there is not only renewal of like behaviour on each several occasion but renewal of like experience on each several occasion. What is renewed is not only behaviour like that of parents and ancestors but experience like that of parents and ancestors. And yet there is no revival. There is retentiveness which provides for renewal in experience without provision for revival. If we like to speak of this as ancestral memory well and good.

But does not 'racial retentiveness' suffice? May not

'ancestral memory' be taken to imply more than this—to imply also remembrance with revival?

I may, then, be asked: Is there not also in the course of individual life 'renewal of revival'—on each occasion, for example, when there is renewed fore-taste of a juicy maggot on Blackie's part? No doubt there is. But this is retentiveness at a higher level (the mid-level) of mental organization. So too there is retentiveness at top-level. Again and again in the course of each day there is for me renewal of time-plan with self in the picture. Retentiveness obtains at all levels of mental organization. At mid-level under remembrance there is the retentiveness that provides for associative revival of acquired fore-experience. At top-level under retrospection there is the retentiveness that provides for the renewal of reflective plans. But under 'ancestral memory', if we elect so to call it, there is as yet no conclusive evidence of inherited fore-plans or of inherited fore-experience. Renewal of experience like that of parents and ancestors? Yes. Revival of parental experience in the form of individual fore-experience? No—or let me, rather, say: I think not on the evidence thus far recorded.

## CHAPTER XII

### *The Ignorance of Animals*

#### § 1

In his Essay on "The Honourable Points of Ignorance" Mr. Crothers says: "I happen to live in a community where there is a deeply rooted prejudice in favour of intelligence, with many facilities for its advancement. I may, therefore, be looked upon as unmindful of my privileges when I confess that my chief pleasures have been found in the more secluded paths of ignorance."

He tells us, however, that he is no indiscriminating lover of Ignorance. He does not pose as an enthusiast. "Mine," he says, "is not the zeal of a new convert, but the sober preference of one to the manner born. I do not look upon it as a panacea, nor, after the manner of reformers, would I insist that it should be taught in the public schools. There are," he admits, "important spheres wherein exact information is much to be preferred." "It is only natural Ignorance which I praise; not that which is acquired. It was a saying of Landor that if a man had a large mind he could afford to let the greater part of it lie fallow. Of course we small proprietors cannot do things on such a generous scale; but it seems to me that if one has only a little mind it is a mistake to keep it all under cultivation. . . . For myself, I like to have a general reception-room in my mind for all sorts of notions with which I desire to keep up only a calling acquaintance. Here let them all be welcomed, good, bad, and indifferent, in the spacious antechamber of my Ignorance. But I am not able to

invite them into my private apartments, for I am living in a small way in cramped quarters, where there is only room for my own convictions. There are many things that are interesting to hear about which I do not care to investigate. If one is willing to give me the result of his speculations on various esoteric doctrines I am ready to receive them in the spirit in which they are offered. I do not know enough about the subject to contradict his assertions, and therefore he would have it all his own way. But were he to become insistent and ask me to look into the matter for myself, I should beg to be excused." Thus Mr. Crothers.

In this chapter my aim is to emphasize the honourable points of ignorance in animal life. But I ask the Gentle Reader to look into the matter for himself at least so far as to check what I have to say by comparing notes in the spacious antechamber of his first-hand experience.

Let us revert to P. G. Hamerton's statement that "in our estimates of the characters of animals we always commit one of two mistakes—either we conclude that they have great knowledge because they are so clever, or else we fancy that they must be stupid because they are so ignorant". His point is that keen perceptive capacity at the unreflective level is not incompatible with ignorance in the sense of absence of reflective knowledge. When one writes in praise of ignorance it is well to make clear what sort of ignorance one means. We talk glibly of the world in which we and animals live. But Carlyle bade us pause when he said: "To Newton and to Newton's dog Diamond what a different pair of universes! while the painting in the optical retina of both was most likely the same." I ask you, Gentle Reader, to pause and to consider what may distinguish this different pair of universes.

First you may wonder whether there is more than one

universe. May not the difference lie in Newton's and Diamond's outlook on that which gives the same painting in the optical retina? Let us make bold to believe that there is one physical universe common to Diamond and to Newton, and nowadays to Einstein. One may do so, for the purpose in hand, without raising the question whether things in the world, as the part of the universe in which each lives, are or are not in some respects dependent for some of their characters—their beauty, their colour, and perhaps fragrance—on sensory acquaintance. By their world, then, I mean that with which they have in some way sensory acquaintance through perception, and that of which they may have knowledge through reflective procedure. If they do have such knowledge, may I say: That is the world as they know it 'through reflective spectacles'?

I am taking the world as knowable for granted. To that world it makes, I assume, no difference whether it is known through reflective spectacles or not. There it is; and it matters not whether the spectacles through which it is known were ground by a Lucretius, a Newton, or an Einstein. As a knowable world it is what it is; as a known world it looks different as 'seen' through these spectacles or those. When did you put on your reflective spectacles? Were you born with them on? Were they put on as a baby in arms; as a child of eighteen months; as a boy of two or three years; or not till you were six or seven? Does Blackie wear his pair, Diamond his pair, Chica hers?

Are these questions psychological or physical? I think they are both; psychological in so far as they concern objective reference to that which is known; physical in so far as they concern that which is knowable under such reference. But it is the world for child or adult—for Diamond or Chica (especially Diamond)—that is now on the *tapis*. I mean the world in which

they live, and to which they adapt their behaviour. So, turning again to first-hand experience, I ask: What is this world for me? What was it for me as the boy of whom I can recollect somewhat under retrospective reference to the past with myself in the picture?

## § 2

If we take the study of the animal mind seriously; if we use reflective imagination judiciously to this end; what we should ask is: How shapes the world to the sensory acquaintance of this or that animal—of the dog, for example? Thus we may get a 'picture' of his mental attitude, and of that world which he pictures. But if I am not mistaken in believing that for the dog there is no reflective picture of the past or the future, and no concept of self, he lives forward in a continuously changing present.

We must ask then: What is this present? It is technically called the specious present, or sometimes the psychological now. In a time-plan framed for the purposes of abstract thought the present may be regarded as an ideal boundary common to past and future. But even for the physics of events that is not good enough. One must make the present broad enough to include at least the minimal duration of a concrete event which, however swift, 'takes time'. In any case such a boundary notion of 'now' is quite out of touch with first-hand experience. To that we must turn.

In first-hand experience no percipient event is instantaneous. It fades away towards the past, and its fading trail, as after-experience, is included within the psychological now. The meteor we see 'now' leaves a trail of light in the sky. Even sound, which fades on the ear much more quickly than does sight on the eye, leaves its trail, as old people in whom it lasts longer know full

well. The notes of a rapid violin passage, they say, run together and are slurred. And they are prone to attribute this to the violinist—so inferior to the masters of *their* young days—and not to this factor in their deafness. Without going into detail we may say that in any whole of sensory experience there lingers in the present a trail of the past.

But in present fore-experience there is, I think, quite unmistakably a 'fringe of futurity', as William James expressed it. It, too, falls within the specious present and therefore falls short of the future to which there is prospective reference under reflective anticipation.

Do you ask me for some instances of my own fore-experience? My trouble is to select from a cloud of witnesses. I cannot of course wholly get rid of self in the picture. But I can turn to that which is predominantly unreflective procedure; and I find fore-experience in nearly all such procedure from morning till night-fall. As I step out of bed there is fore-experience of my foot reaching the floor and of the coming poise of my body. As I get into bed there is fore-experience of the feel of the sheets and the touch of the pillow. I take my walks abroad through familiar scenes. I have doffed my thinking-cap and am bare headed in unreflective 'ignorance'. But all the while, at every turn, fore-experience as *avant-courier* of what is next coming marches just ahead; but only just ahead; still part of the psychological now as its forward fringe to balance its backward trail. Is this so, though baldly and tersely stated? Ask this question of the one you know best—yourself.

Such an ignorant but eminently serviceable *avant-courier* I impute in full measure to Ginger as he nears the by-path where once he hunted a coney.

§ 3

But has Ginger no self in the picture? Have I no self in the picture when my outlook and my acts are unreflective? I turn again to first-hand experience. I find that, though I claim to be a self-conscious being, I am not self-conscious all day long. And even while I am reflective and self-conscious at top-level there is much of my behaviour and my experience which runs its course unreflectively at the mid-level of naïve perception. There are scores of habitual acts which I perform without thinking of myself as doing them. There are scores of instances of sensory experience and fore-experience which I naïvely accept as they come in daily routine without thinking of myself as now having them, having had them, or likely to have them again. So far as I can discover they carry, in my first-hand experience, no more than a trail of the past and a fringe of futurity. They do not carry retrospective reference to myself in a picture of the past or prospective reference to myself in a picture of the future.

Of course any one of them may do so; but then I cease to be unreflective; I step up to the level of reflection. Then I feel a change of mental attitude. I no longer take the present course of events as they come along; I hark back retrospectively or leap forward prospectively. And there I am as I was on some previous occasion; there I am as I probably shall be on some coming occasion, say next week.

I say: There I am; hoping that you understand what I mean on the basis of your own experience. But I add: There I am in *the picture* of the past or the future. The picture is that of some specious present in the past as it was, or of the future as it will be. And in that picture there is my awareness within the specious present at the time-being.



Under awareness, as I have asked leave to use this word (p. 28), one is aware in seeing, hearing, touching, or in any other mode of sensory percipience; one is aware in behaving; one is aware in being hungry, or in any other form of urge; one is aware in the affective tone of enjoyment, pleasurable or the reverse; one is aware in all fore-experiencing (fore-tasting, fore-seeing, and the rest) and in the perceiving to which this is contributory; one is aware in reflecting, in picturing, in planning. There is awareness at the back, so to speak, of any mental process of any kind in animals no less than in you or me.

On this understanding there is no mind, at any level or stage of mentality, without awareness. Clearly, then, there is awareness within every specious present or psychological now at the unreflective, no less than the reflective, stage of mental development. The question therefore is: Should we comprise this awareness, even if it be unreflective, under that which we speak of as the self? Why not do so, if we add some such qualifying words as the self 'which is felt in awareness'? It is not, as thus felt, a *concept* of self, for that is reflective. It is the ignorant self—not yet the self for thought. Such an ignorant self, but a very real self, there is in every living animal.

But for the unreflective, and in that sense ignorant, animal, it is always a self within the present, though continuously advancing 'now'. If the past is dead and gone, dead and gone too is the self of any 'now' in the past. The future self is yet unborn. The self, however, is 'dead and gone' or 'still unborn' *for the mind as ignorant or unreflective*. For the reflective mind—for your mind and mine—there is a conceptual 'picture' or representation of the past, present, and future, as we believe they really exist, with a 'picture' or concept of a real self therein. There is, too, a conceptual picture of that which we have learnt to call space.

## § 4

As the Gentle Reader may perchance have discovered, a psychologist can be a terribly sophisticated being. I seek now to rub off the slate this highly sophisticated me and leave only the very ordinary me that left my desk an hour or so ago, went out for a walk, and saw among other things a steamer put off from the Hastings pier and dwindle towards Boulogne. I just took occurrences in this little corner of the world as they came. But it was a bit of the world as known to me through reflective spectacles. It was not merely seen by the naked eye of naïve perception. That no doubt it was. But it was also a world 'transformed' under reflection.

I am back at my desk. There is here and now for me a memory-picture of what I then saw, with myself in the picture. But there is also a *memory-plan* of what I saw and of much that lay beyond—Boulogne, for example; let me say a *space-plan*. And this *space-plan* is known only through reflective spectacles. When, with reference to such occasions, I dive into first-hand experience, my finding is that seldom, and then with difficulty, do I take off these spectacles. Normally, as I take my walks abroad, I see everything subject to a *space-plan*.

I venture to think that we all do so. And under the sway of a concept of 'physical reality', as it is incorporated in our 'common-sense outlook', we commonly distinguish the untransformed world of perceptive acquaintance as that of 'appearance' from the transformed world which we speak of as 'real'. The clock-face which under sensory acquaintance is generally more or less elliptical, save from one point of view, we speak of as round; the picture-frame which seldom is so in appearance, we call square; we say that the seemingly convergent railway lines are parallel, and so on—an oft-told tale. The steamer which

for direct acquaintance (and in the language of direct acquaintance) 'dwindles' is, we say, really of the same size but more distant. Without putting it in so many words such as 'the further it is off the smaller it looks', we have come to regard this as a matter of course.

I must not labour this point, which is, in brief, that we carry about with us a space-plan within which anything that we see has its 'real' place, size, and shape; and that if there is something wrong about the look of things, we attribute this to displacement or distortion in 'appearance' from the particular point of view, or under peculiar circumstances—mirror images, the bent stick in the water, and so forth. The space-plan in which the world is nicely four-square—this space-plan rules.

Now if I look back retrospectively to my childhood I cannot recollect occasions when this was not so in first-hand experience, though of course I can recollect sundry steps in advance in its reflective development—getting hold, for example, of the notion of 'dimensions'. I can dimly recollect when the 'appearance-reality' problem began to bother me, picturing a discomfited boy at my grandfather's breakfast-table, thoroughly bamboozled by his questions—'to make the youngster think'.

The problem bothers me still. But I see a little more light. It seems to me now (to make a long story short) that if we start with a four-square space-plan the question is: Under what conditions do things look other than four-square? So the logician, who thus starts, regards appearances as departures divergent from reality. If, on the other hand, we set forth from perceptive acquaintance, as does the psychologist, the question is: At what stage of mental development does the four-square space-plan arise and by what steps does it reach approximate convergence in reality? No doubt matters are nowadays not so simple as this, since New Realist doctrines of 'sensa' have come into view. But they are generally

discussed from a logical rather than from a psychological (developmental) standpoint.

It is the psychological line of approach which here concerns us. It is in a psychological sense that I speak of a world 'transformed'. I mean transformed under reflective procedure, or transformed as it comes to be known through reflective spectacles.

I said that I could not retrospectively envisage any occasion in my childhood on which I had not a space-plan in mind, if it were only a rude ground-plan and crude elevation of the nursery, the house, the garden, the roads, and the rest of my small world. And yet I believe that there was a time in my life when I had no space-plan; a time to which I am unable to go back retrospectively because there was no concept of self to put into the picture and no pictured space-plan in which it could have place; a time when I was perceptive only, preceded by a time when I was percipient only—at birth, let us say, and thereafter on sundry first occasions of instinctive behaviour.

Even then my body-mind was in spatial relations to the physical world. How did mental reference to the spatial attributes of this world develop?

Let us deal with an imaginary being who starts as percipient and see how far he could get if he became in due course perceptive also.

As percipient at the instinctive stage of behaviour he lives forward 'in space and time'; and yet *for him* there is neither time nor space save within the specious present. Beyond this specious present there is for him no future, no past. For him there is only a sequence of 'nows'; for him, too, only a slide along 'heres'. The 'nows' are nowise related to 'thens' before or after; the 'heres' nowise related to other such positions as 'theres'. Even the words 'now' and 'here' are bereft of meaning since they no longer imply, as for us, 'here *and not there*' or

'now and not then'. For him there is no 'then', no 'there'. All one can say of such a being is that he lives forward, with fullness of percipience and awareness, in the here and the now.

With the advent of fore-experience he becomes perceptive without ceasing to be percipient. This fore-experience is still within the specious present. But there is not only a 'fringe of futurity', there is also a 'fringe of spatiality'. In both there is a 'fringe of expectancy' so long as we restrict this expectancy to the specious present.

But with this there comes some mental forestalling of coming events. For expectancy in fore-experience precedes, as *avant-courier*, the course of events in merely living forward. There is fore-here-ness of the space into which the perceptive being lives forward. And this is the perceptive germ of the 'there'. It is hard to put into words—the current coin of reflection—what this 'feels like'. If one tries to do so it comes to something like this: Here am I in current experience; and yet I am already there in pre-current fore-experience.

How far will this take us at the still unreflective and ignorant stage of mental development? I think a long way. I believe that it suffices for the child up to the dawn of reflection, suffices too for Blackie, and even for Ginger, throughout life. But for Chica it seems, if we accept Dr. Köhler's finding, not quite to suffice.

Of course this fringe of expectancy grows richer and richer as perceptive development proceeds. More and more is included in the progressively unified whole of perceptive reference. Wherever Ginger has been, on Table Mountain for example, expectancy of being there again comes to mind as he nears the place. He is there just before he gets there. There-ness is for him always closely precedent to here-ness. But always in the fringe of expectancy; always, at any given moment, a fore-

runner within the psychological now of the specious present.

But surely, the Gentle Reader may say, for this you have no voucher in your first-hand experience.

Were that so, I should have no grounds for imputing this to the animal mind. But I believe I can picture what it 'feels like'.

One has to reduce oneself, so far as one can, to unreflective mental stature. One must catch oneself when one is neither prospective nor retrospective; when one is close up to what one is doing and thinks least about it; when there is little scope for aught but the fringe of expectancy, and a concept of self drops out of the picture; when one is conscious but scarcely self-conscious [*A.B.* 153]; when one does the right thing on the spot and not till afterwards realizes that it was the right thing to do.

This is best illustrated in episodes in the course of rapid and highly-skilled action—in fencing, in cycling, in playing tennis, in batting; even in running rapidly down stairs; in all cases of swift and sure adjustment 'on the spur of the moment'. Here one's acts seem to be shut up in the specious present with, at the time, little prospective or retrospective reference. Here one's mental attitude is most closely akin to that which may be imputed to the animal in the performance of his wonderfully skilled acts. No doubt our own skilled acts are subject to plan and are so far carried out in subservience to some end in view. But *then* we are thinking about them and their outcome prospectively. We should try to get down to the sheer doing of them and to what, in current phrase, it then 'feels like'. When we do so—when we take off the reflective spectacles furnished to us by Newton—we are nearest to Diamond's outlook on the world.

There is ignorance and ignorance. The Diamonds

among animals are, I believe, unreflectively ignorant of the world transformed by the thought of the Newtons among mankind, or even transformed by such modicum of knowledge as that to which the child of four or five years falls heir. But in their world, for them untransformed, the outcome of their clever ignorance often sets problems which the best reflective knowledge of to-day is unable to solve.

Few animals may reach the reflective level of mentality. Take them, then, in their world untransformed; observe them as they tackle their practical 'problems'. Their honourable points of unreflective ignorance again and again disclose our reflective ignorance, and put our tentative knowledge to the blush.

## CHAPTER XIII

### *Chiefly Plain Tale*

#### § 1

Although Mr. Crothers tells us that the Gentle Reader likes 'one thing at a time' it is by no means easy to keep to one thing at a time. If we take the world as we find it, many things are going on together all the time. One may, perhaps, with difficulty keep one's attention fixed on one thing at a time. But other things have an insidious way of intervening and diverting one's attention to them.

I have done my best to keep in this book to one thing at a time in the sense that I deal only with the relations that obtain in the life of animals. But have you not again and again wanted to know *why*, when such and such relations obtain, this or that happens? And are you quite content when I say: One thing at a time; when I say: Let us fix our attention on what *does* happen and on the relations that *do* obtain? I question whether the Gentle Reader does like to keep strictly to one thing at a time.

Apart, however, from this 'methodological' procedure, I have suggested that one may distinguish what I have called a plain tale of observable behaviour from an interpretation of that behaviour in terms of body-story and in terms of mind-story. And I have suggested that, in our topic, it is sound 'methodological' procedure to take one at a time and to start with a plain tale recorded under careful observation. As I write I learn that a pigmy hippopotamus was born in the Zoo last Sunday



morning (May 11, 1930); and that it was able to walk almost at once. I read in *The Times* that "the pond was at once emptied, cleaned, disinfected, and refilled. When the water had reached a temperature of 90 degrees the mother was given access to it, because in the case of the common hippopotamus suckling always takes place in the water. The mother and calf remained quiet all day, and Bowman, the keeper, at his own request, stayed in the House on Sunday night to watch events. Soon before midnight, and again at 2 a.m. and 4.30 a.m., the calf was suckled, and about 5.30 on Monday morning the mother, leaving the calf asleep, went into the pond and stayed there for some time, returning about 7.30 to suckle the calf, which she has continued to do, always out of the water, at intervals of about two hours. Later in the day the mother took the calf into the water and the little animal at once began to swim and submerge itself quite like an adult."

This I call a plain tale of events. Even when I am told that the period of gestation was 247 days, though the word 'gestation' belongs to body-story, the statement is just plain tale.

But I do not claim that any hard and fast line of division can be drawn between plain tale and body-story. For much body-story is given in plain tale, whereas mind-story is always a matter of imputation.

Let me illustrate what I mean when I say that much body-story is given in plain tale. The little Æsop prawn, in its early days almost colourless and transparent, is washed inshore and clings to a piece of sea-weed. The weed may be, let us say, green or brown or red. The prawn gradually takes on colour, and in a week or so it, too, is green or brown or red, matching the colour markings of the weed to which it clings. But at night, whatever may have been its colour day by day, it turns blue. That again is just plain tale.

What happens? Something happens in the body and this belongs to body-story. A great number of pigment cells are developed, each with delicate extensions around a centre; each with three pigments, blue, yellow and red. The colour of the prawn depends on the spread of these pigments in the extensions; red only, blue only (at night), yellow or blue, or some combination of all three.

But the way in which they spread—the manner of their spreading—though it happens within the body and calls for body-story interpretation, physiological and biochemical, can be described in microscopic plain tale.

Of course we want to know more about the whole business; in what way the pigment cells are influenced by light-waves directly or through the eyes; what happens at night; what nerve-processes then occur; by what chemical changes the pigments (originally nutritive in function?) are severally produced; and so on. We are led on to a body-story interpretation. We may be led on also to a mind-story interpretation. We are told that if a red *Æsop* be put in an aquarium with red and brown sea-weed it will settle on the red; but if there be green sea-grass only it will settle on a piece of this and in the course of a few days will itself turn green. Here the question arises: Should we impute to the prawn not only percipience but perceptive discrimination and choice? And thus we pass beyond plain tale.

And then one is tempted to carry imputation beyond the cramped limits of the mind of *Hippolyte* the prawn. We watch the development not only of the colour but also of the pattern of its background. The artist within us is stirred. "As a skilled painter," we are told, "almost unconsciously lays down the groundwork of his sketch, manipulating the purity and mixture of his colours, controlling them by eye, and putting in the high lights against a body colour, so does the eye of the prawn

unconsciously supervise the painting of the surrounding scene that unseen hands are rendering, both in relief and colour, upon its own skin. As there are certain rules of composition in painting, certain old proprieties to be observed, which taste has evolved and custom obeys, so there are certain lines along which the skin-painting of the prawn begins; certain areas along the back and breast and across the body along which the invisible hand first works before filling up the canvas." When the late Professor Gamble, to whom we owe so much on this topic, wrote these words, I venture to think that as a distinguished man of science he was temporarily 'off duty'.

But the plain tale of Hippolyte, and many another, opens up the wide field of protective resemblance and thus invites us to consider the whole situation in terms of expression and impression (p. 97). On the one hand there is expression in colour, pattern, form; on the other hand there is impression on some other animal. Here, too, one wants first to get at plain tale under observation. But here, under impression, we can scarcely refrain from passing over to mind-story. Furthermore, we find instances of animals that so 'bedeck themselves' in expression as to minister to impression on others. So the plot thickens, and we are reminded of adornment in Chica (p. 88). We feel that some interpretation in terms of mind-story is demanded. The comparative psychologist may (or may not) be called in to give expert advice. But the first thing he asks is: What is the plain tale of that which observably happens?

## § 2

When we deal with any episode in the behaviour of an animal, we may interpret what happens in terms of physiological body-story, or in terms of mind-story, or

in terms of both. But in broader view the body-story which refers to some episode on this or that occasion expands into life-history which includes all episodes on all occasions from conception till death; and the mind-story expands in like manner.

Here arises a difficulty. Both stories in historical expansion are based on plain tale in *its* historical expansion. But how seldom, if ever, can we get a plain-tale record of observation giving, even in summary form, all the salient episodes in the course of individual development. That is what we want. Nay more. We would fain have also an inferential record of the whole racial history in a vastly expanded plain tale taking us further and further back in the long stretch of the evolutionary past.

These are commonplaces. But should they not be borne steadily in mind? Do we bear steadily in mind how many, and often how wide, are the gaps in any plain-tale history even in the life-time of the individual taken as representative of his species or race?

No doubt day by day fuller knowledge enables us to fill in, bit by bit, the unobserved gaps in some plain-tale record by borrowing from the records of observations on other and more or less closely allied animals. That is how we build our constructive schemes of animal behaviour, and no doubt we call to our aid the method of experiment in suchwise that, under conditions within our control, further light may be shed on the hidden natural conditions under which behaviour runs its course in normal circumstances.

Since the foregoing considerations are rather general in their tenor, let me illustrate by an example.

In the Severn and its tributaries one may watch year by year in due season myriads of small eels or 'elvers'—slender little fellows two or three inches long—swimming near the bank, and always up current. One gets

just a little segment of a long plain-tale history, which bit by bit has been told in some such outline sketch as this. They were hatched far out in the Atlantic some time ago; at last they reach this tributary of the Severn (or other river) and up stream they go; they will find their way to fresh-water pools, grow apace, and reach maturity; then they will return down stream, swimming with the flow of the current; they will thus reach the open sea, travel hundreds of miles to the distant Sargasso, breed there, and thus initiate a new life-cycle.

From stream-mouth in ascent to stream-mouth in descent they may occasionally be under observation. But who, under like observation, can follow in detail the course of their ocean journey? Who can say: These are the environing conditions of the long pilgrimage landwards; these the environing conditions on return to the Sargasso? As matter of plain tale, details of the exact relation to the surroundings which renders the behaviour what it presumably is, are lacking. Why not say so? Why not frankly confess ignorance with regard to the very important details concerning which knowledge is as yet lacking?

Here let me pause. Let me ask you, Gentle Reader, to lay your hand on your heart, and say whether, as you read the foregoing paragraphs, you did not slip over from a plain-tale description of that which is reported to happen to an interpretation in terms of mind-story. Did there not lurk at the back of your mind something like this? To account for these plain-tale facts there 'must be' on the part of the elver some anticipation of the fresh-water pool he will reach; on the part of the mature eel some retrospective memory of the Sargasso which he left awhile since and to which he will return.

Whether you did so or not I cannot tell. But I venture to say that this is what many regard as the

obvious common sense of the matter. They impute to the eel something hard to distinguish from reflective procedure. So be it. But I, for one, and not a few others, do not feel justified in imputing to eels, infant or adult, either anticipation or retrospective memory.

I am ready to impute to them some measure of perceptive procedure; but this mainly because in the class of fishes, of which they are by no means lowly members, there is good evidence of fore-experience—of fore-taste for example.

In Dr. E. J. Allen's experiments [*L.M.S.* 112] with Pollack and Rudd at the Plymouth Marine Laboratory electric 'buzzers' were rigged up in sealed tins suspended in the tank. At first, and for some time, there was no clear evidence that the fishes were affected by the vibrations transmitted through the water. Food was then placed day by day in the neighbourhood of the buzzer. After a time when the electric current was switched on in the buzzer (with no food near) the fishes assembled round it, apparently on the look-out for such food as had been there *on previous occasions*. Two buzzers, some twelve feet apart, were fitted in the tank. By switching on one or other alternately, the fishes could be drawn to and fro towards that one which was set in vibration. Does not this afford evidence on which one may justifiably impute to some fishes fore-taste and perceptive procedure?

Even so, however, need one impute to the eel that swims up stream or down stream more than the percipience that is adjunct to instinctive behaviour? If not, in accordance with our canon (p. 22) we should not interpret in terms of the higher if the lower level of mentality suffices.

What happens? The elver is stimulated by running water and he swims up-current. In tidal water, with alternating current, he forges ahead, now against the

flow, now against the ebb. But since ebb lasts longer than flow, there is an upward balance of progress in tidal water. Beyond tidal influence there is pretty steady progress up stream. He is bound with some halts to reach the sweet-water pools.

But why not experiment? Put a dozen elvers in a bowl of water and stir in one direction. Every one of them noses upward against the current. Now stir in the opposite direction. Every one of them turns round and swims nose to current. It seems that direction of current in the environing water affords adequate and sufficient stimulation, and that, given this stimulation, up stream he goes in his elver state.

But how comes it that when he reaches mature eel-hood he behaves quite differently? Then under similar stimulation of water-flow, *down stream* he goes. Then, if you reverse the flow of water in a trough or leet he turns round to go down current. (Parenthetically I may add that this experiment was made at night.) How comes it that under like stimulation he swims up stream as elver and down stream as mature eel? It does not seem that any mode of fore-experience is on the *tapis*. The behaviour in each case seems to be instinctive. How, then, is one to interpret this *volte-face*? I reply: On the hypothesis that something has happened *in the eel himself*: that in his maturity he is no longer the elver that he was; that in some way his state of body (physiological) and of percipient mind (psychological) has undergone a change in organization. There, frankly as an hypothesis, we must leave it for the present.

Revert now to plain tale as it may be interpreted under body-story and also under mind-story. The net result in plain tale is that he gets there. Given instinctive behaviour under stimulation by running water, the elver on reaching a tributary stream is bound to get to some sweet-water pool; the mature eel by swimming down

and down is bound to find the ocean. But on reaching the ocean how does he find the Sargasso; on leaving the Sargasso how do his offspring find the Severn estuary? I, for one, do not know. One is prone to guess. At a mere guess the fry *may* radiate outwards all round the compass; some of them are then bound to find the Severn. They alone concern us. Never mind about the rest.

Were it so, compare this with migration in birds. Dr. J. B. Watson tells us how a Noddy Tern was taken from the Tortugas in the hold of a ship with devious course some eight hundred miles northward, far from land; was there released; and was home again within two or three days.

Much has been written on bird-migration. What happens in plain tale, in this case and in that, is becoming better and better known. There are unquestionably seasonal changes in body-story and in mind-story. But does the route taken depend on some fore-experience? Is there perceptive guidance of behaviour? I think there is evidence to justify one in saying: Not in all cases. If, then, the behaviour has an underlying instinctive character, is there some mode of percipience concerning which as yet we know little or nothing—some 'sense of direction', some 'magnetic sense', or what not? I frankly confess that I do not know. I surmise that in the wide range of animal life and mind there may be many modes of percipience to which there is nothing that quite tallies in my own first-hand experience.

### § 3

I have suggested that a distinction, at least helpful in practice, may be drawn between a plain tale of behaviour and an interpretation of that behaviour in terms of body-story and in terms of mind-story. But let me



beg the Gentle Reader to remember that I invite him to regard these distinctions as aids to an inquiry into that which is an indivisible whole. To account for the observable behaviour of this or that animal, there is not, as I believe, a mind-story apart from the body-story; nor is there a body-story apart from the mind-story. There is always the one together with the other.

It may be asked: Why should we not rest content with plain tale? Why should we bother about further interpretation? I am not prepared with an answer, save the obvious one that this is how some of us are constituted. But I take it that the fuller our knowledge of the course of nature the more does our generalized record of what happens approximate to plain tale. In other words: If we knew all the kinds and modes of relationship that now obtain, and will obtain in the future, we should know all that happens in glorified plain tale.

As things are, it is where there is some element of surprise in the course which a plain tale takes that we seek an interpretation of the unexpected change; in the case, for example, of the eel that now swims against the current and now with it. Something hidden from the eye of plain-tale observation is in the relational field. The higher the mentality that, on general grounds, we impute to the animal, the more readily we turn to mind-story, taking perhaps some body-story for granted. In the case, however, of the lower organisms, the unicellular animalcules, for instance, we may be puzzled. They are so different from us. And yet, even here, the trouble is that it is far easier to interpret in psychological terms based on our own first-hand experience, than to interpret in terms of physiological organization. And for most of us 'a change of physiological state' means scarcely more than 'that of which we know little or nothing'.

Let us, however, 'descend to particulars'. Let us take a brief view [*L.M.S.* 54] of the behaviour of the unicellular animal Stentor. Its slender 'stalk' is attached to some support, its 'body' is swollen in trumpet shape. A gelatinous sheath or tube is secreted into which the organism can be withdrawn. A wreath of cilia bounds the spiral 'peristome' of the trumpet, near the inner end of which lies the mouth; ciliary action in this wreath gives rise to an inwardly directed vortex current of water. Under experimental conditions carmine particles are suspended in the water.

The plain tale of behaviour, as recorded by Dr. H. S. Jennings, runs thus. At first the extended Stentor does not observably respond. After stimulation has continued for a short time the organism responds by turning this way or that. Then, after several repetitions of this reaction, there is a new response—reversal of the ciliary action. Next, the Stentor contracts strongly and repeatedly; does so still more markedly; and finally, breaking the attachment to the sheath, swims off.

Turn now to the interpretation that, as I understand, Dr. Jennings offers. First and foremost he says that a mechanical interpretation of this plain tale does not adequately cover the observable facts. The interpretation he offers is physiological. There are serial changes of behaviour though the stimulation is pretty uniform. Take, for example, the reversal of ciliary action. At first the response to stimulation is *this*; subsequent to change the response to like stimulation is *that*. What, then, has changed? The physiological state of the organism. It is the Stentor that has changed from 'this' to 'that'; and the observable behaviour is the expression of this change of organization. But how is this change of organization to be interpreted?

I take it that the sort of thing which may be said is that the continuance of initial stimulation upsets the

balance of organization which topples over to a new poise; but that this is not all. The enhanced ciliary action at one stage may flood the Stentor with biochemical products which so accumulate as further to upset the balance of organization and conduce to its toppling over to a radically new poise under which the ciliary action is reversed. This, or the like, no doubt savours strongly of hypothesis. So here the biochemist, as highly trained expert, takes up the running. In his hands we must leave the matter.

I have somewhat departed from my text—the interpretation which Dr. Jennings offers. Let me summarize the three points that appear to stand out. (1) A ‘mechanical’ interpretation is nowise good enough. (2) In a physiological interpretation, a change from *this* behaviour to *that* is the expression of a change from one physiological state of the organism to another and different state. (3) The physiologist, as such, neither asserts nor denies the co-presence of mental relations, but he does contend that, whether they be co-present or not, they do not come into *his* picture.

If, with respect to my third heading, the Gentle Reader should remind me that Dr. Jennings frequently uses the word ‘perception’, and sometimes ‘memory’, I beg him to go direct to Dr. Jennings’ writings and note carefully the safeguards under which he uses words of this ilk. “Thus ‘perception’ of a stimulus means merely that the organism reacts to it in some way; ‘discrimination’ of two stimuli means that it acts differently to them.” “The word ‘memory’ is used here of the objective phenomenon that in many animals present behaviour is modified in accordance with past stimuli received, or past reactions given. Of possible subjective accompaniments we, of course, know nothing directly so far as the lower organisms are concerned.”

So long as he deals, as observer, with plain tale; so

long as he interprets in terms of changes of organization in body-story, Dr. Jennings is careful to make clear that he does not impute anything mental, or as he says 'subjective', to unicellular organisms. That, however, does not imply an assertion that in their case there is no mind-story.

I gather that he may be prepared to impute somewhat; but how much or how little I cannot say. I am not sure whether he would impute some measure of fore-experience. That, for me, raises the crucial question. I am prepared to impute to them percipience, an urge of the nature of hunger, awareness in behaving, not improbably affective tone, pleasurable, in some dim sense, or the reverse. But I do not find anything in the evidence on record in respect of the plain tale of behaviour in any unicellular animal which leads me to believe that the change from *this* form of behaviour to *that* can only be interpreted if we impute fore-experience of that which is just coming. I find nothing that leads me to impute mentality at the perceptive level of procedure to Stentor or another. The most that I could admit is a hesitant 'perhaps'. So I leave micro-organisms in the dubious lap of the 'maybe', and say no more about them.

## CHAPTER XIV

### *A Glance at Body-Story*

#### § 1

Although I believe that body-story and mind-story have reference to *one* system of organic events; although I believe that they are distinguishable only in so far as they deal with relations that differ in kind; although I believe that neither kind is ever present in the absence of the other; although I am prepared to urge that no one can have adequate knowledge of any animal's mind-story who has not sufficient acquaintance with his body-story;—still it is not within my province in this book to attempt an exposition of body-story under physiological interpretation. But I take it to be within my province to indicate, without entering into detail, in what ways, as I think, body-story does shed light, and shows good promise of throwing further and fuller light, on that mind-story which is our primary concern.

We have seen that observable changes in the course of the behaviour of Stentor may be interpreted as the expression of hidden changes of physiological state. But this calls for expert knowledge of biochemistry. And few of us have more than a bowing acquaintance with this difficult branch of science. Most of us, however, have intimate experience of ends in view and motives which spur us on to their attainment. So when we listen to body-story of which we know so little, we can scarcely refrain from interpolating a bit of mind-story. And we are naturally prone to impute a bit of *our* reflective mind-story that we may thereby account

for the observable behaviour of some animal far lower in mental status.

We see perhaps some caterpillar ascending the branches of a shrub to its feeding-ground of foliage. Later on, when he is 'fat and full', we see him descend to the ground beneath and pupate in the soil. Are we not prone to impute to him something like 'motives' for doing what he does? But that is not body-story. And a body-story there is. Some change of bodily state has come. Under what physiological conditions? Ask the biochemist. He may not as yet be able to give an answer in satisfactory detail. Then let him prosecute with all diligence further inquiry until in due time perchance he is able to do so. Ask him what he thinks of the suggestion that it would much simplify his task if he introduced 'a little dose of motive'. Methinks his reply will be brief: Motives are no use whatever to me if I stick to my job.

From Stentor to caterpillar, from caterpillar to eel, from eel perhaps to Lapwing—in each case a far cry! But in each case something in common; in each case a reversal of behaviour with change of state—reversal of ciliary action in Stentor; reversal of ascent to descent in the caterpillar; reversal of response to stream-flow in the eel; a more complicated reversal of behaviour in the Lapwing.

If one watches, through the observant eye of Mr. H. Eliot Howard, the behaviour of Lapwings, one finds that in the winter they live together in flocks. There is then little difference in the behaviour of a male towards females and towards other males. But as the season advances the males separate out, and each secures a territory, of which there are no visible boundaries. In successive seasons a meadow may be partitioned out into occupied areas with boundaries different this year from those of last year. But when the territories are

established a change in the behaviour of the occupant is in evidence. Some female is attracted and becomes the mate; the intrusion of any male calls forth hostile behaviour. If, however, there should be a cold-snap in the weather, the Lapwings revert to the earlier state of matters that is observed in the flock. The male then shows no hostility to other males. Thus, there is a flock-phase, and a territory-phase, with difference of behaviour in each phase. These differences are so marked that one may speak of reversal of behaviour with some change of bodily state.

It has long been believed that changes of state during the breeding season in birds and other animals are in some way connected with changes in the organs of reproduction. During the last thirty years it has been shown that, apart from their main function of disengaging germ-cells or sperm-cells, these organs are also glands which produce 'internal secretions', containing 'hormones', that are distributed by the blood-stream throughout the body, act as excitants or depressors of other bodily processes, and enhance or diminish the action of other 'endocrine glands' in producing other internal secretions.

When a cat is violently excited by a dog, and presumably experiences fear and perhaps anger, its adrenal glands are called into strong action. Its bodily system is flooded by an internal secretion containing 'adrenalin'. The whole physiological poise is then altered and with it the behaviour of the animal. So far as we can judge the whole mental attitude undergoes a co-related change. And if blood highly charged with adrenalin is injected into another cat, the whole physiological state, and seemingly the mental attitude, of *this* animal is altered in a similar manner.

With respect to the nature of the bodily change of state, Dr. W. B. Cannon tells us that there is increased

liberation of sugar from the liver, and the presence of this sugar in the blood-stream enhances muscular action. There is withdrawal of blood from the abdominal viscera, and an augmented supply to the heart, lungs, central nervous system, and muscles concerned in overt behaviour. These muscles are thus rendered less liable to fatigue. There is much else, but this may suffice.

I am well aware that some of Dr. Cannon's findings have been subjected to criticism. My aim is merely to show the kind of evidence which, on due sifting, points to the co-relation of emotional attitude in mind-story with endocrine poise in body-story. The observed behaviour is an expression common to both. No doubt this behaviour, under normal conditions, is nicely adapted to the circumstances in the situation at the time-being. If that were not so, what would be the actuarial expectation of the continuance of the animal's life?

I revert now to the Lapwing, or other bird, during the breeding season. If I may put the matter picturesquely, it is scarcely too much to say that, in body-story, the bird is under the sex-sway of internal secretions effluent from the organs of reproduction in their capacity of endocrine glands. A cold-snap may in some way upset the balance, and the Lapwing may revert from the territory phase in sexual flood to the flock-phase at ebb tide. And it seems from Mr. Eliot Howard's observations that the hen-bird accepts her mate only when the endocrine sex-flood is at a critical phase at the top of the tide.

It may here be asked: How comes it that the mental attitude of fear (let us say) in the cat, or 'mate-iness' in the bird, 'goes together with' strong adrenalin or sex-hormone excitation in the body? One might just as well ask: How comes it that a mode of percipience (red, let us say) 'goes together with' a special mode of stimulation of 'receptors' in the retina? The two



questions are on the same footing. And the answer to both is the same, namely: Such is the constitution of nature. We just find that they *do* go together; that they *are* thus co-related; and we loyally accept what we find.

## § 2

The story I attempt to tell as best I can is that which has reference to the animal mind. But Blackie, or Tony, or Julius, is not only a mind, he is also a body. This being so, I seek to put myself in the Gentle Reader's place; and I suppose him to say: What about brother body? I reply: Ask the physiologist. I then suppose the Gentle Reader to say: I don't wish you to enter into erudite details, but I should like to know in a general way what you think brother body is doing all the time.

So in response to this not improbable request I have already said something in a general way and will add something more. The something I have thus far said comes to this. The body is a physiological and biochemical system of events continually passing from one poise of moving equilibrium to another, partly under internal conditions of excitation as a going concern, partly under stimulation from an external environment. That as I read it, apart from multitudinous details, is the body-story.

But (you will say) how do you link this up with mind-story? Now in mind-story there is on the one hand subjective awareness in this or that mode of experiencing, and on the other hand objective reference to that which is experienced, under percipience, under perception, or under reflection. Let us first turn our attention to awareness in experiencing, leaving objective reference on one side for awhile. Then all one can say in a general way is that this awareness is co-related with some current poise of physiological state in some part of the body, and with the changes of poise which

occur in living forward. Such awareness or change of awareness is the characterizing feature of that which I have spoken of as urge, or desire, in hunger for example—food-hunger or sex-hunger..

Here, however, we are in difficulties. For when I think about my hunger-awareness it is then, for me, an object of reflective reference. I say; I know that I am hungry. Hence the question arises: Is it psychologically the same to be hungry and to know that one is hungry? I think not. In my first-hand experience they seem to be quite different. The one is just awareness; the other is reference to awareness with a concept of self in the picture. But this is reflective. Awareness, I believe, including such awareness as is exemplified by hunger, accompanies instinctive behaviour; but at the percipient stage of mentality there is no conscious reference to such awareness. This, however, is mind-story; and my aim in introducing it here is again to emphasize the distinction between subjective awareness and objective reference.

In body-story the question is: What are the physiological conditions which obtain when we impute food-hunger to Blackie or sex-hunger to the Great Crested Grebe? You must turn to the physiologist for a reply. He is a specialist. He will base his reply on many minute and intricate details. In the course of his inquiry he has been led to take into consideration the whole poise of the organism. He will present to you the net result of his conclusions on lines similar to those on which Dr. J. S. Haldane has elucidated for you the physiology of respiration.

But so long as he keeps close to his own proper task in discussing hunger he has, paradoxically, nothing whatever to do with hunger as a mode of awareness. None the less, talking matters over with his friend and close ally the psychologist, he may ask: Is there not

room in the realm of natural events for both of us—for you who deal with mental relations, and for me in my discussion of relations within the body? In the joint organization of body-mind, may not the two sets of relations co-exist and neither interfere with the other?

That they do so co-exist, in intimate co-relation within the living organism, as to constitute a unitary whole, organically one and indivisible, is my reiterated belief. And if it be asked: How comes it that a given physiological poise takes form as just this and no other mode of awareness? I can only reply: This is what we find under the organic constitution of nature (p. 238).

When one is asked to state in a general way in what manner awareness in mind, and a physiological poise in the body, are co-related, one can only reply: In that general way which is exemplified in thousands of special ways. Each of these special ways demands minute and intimate knowledge of physiology up to date. So the reply in a general way comes to this: The number of special co-relations on record is such as to lend day by day more and more support to the belief: Never one without the other.

### § 3

I take it that awareness in experiencing is always confined to the specious present. Hunger may last a long time. But feeling hungry is at some given psychological now. And I take it that the specious present does not come within the purview of the physiologist. Apart from first-hand experience, a fringe of futurity or a trail of the past is a matter of imputation. And neither with experience nor with imputation has the physiologist as such any concern. I mean, of course, experience on the part of the living being whose physiological reactions are under investigation.

We have now to take awareness in experiencing for granted that we may turn our attention to objective reference. Here the salient question is: What happens in body-story, as interpreted by the physiologist, which is co-related with the advent of fore-experience in mind-story?

It is sufficiently clear that the answer to this question hinges on the time-order of events. We may safely assume for the purpose in hand that there is one physical time-order—expressed, let us say, in the commonly accepted clock-order. But we must distinguish (1) the time-order of events in the environment; (2) the time-order of events in the body; and (3) the time-order of reference in the mind as perceptive.

We need not trouble much over (1) and (2), though the distinction does come into our problem. It does so because of the difference in the rate of transmission of physical influence from some set of events in the environment to sensory receptors in the body. Hence two events in the body, related as before and after with an interval of some seconds or more, may be consequent on the occurrence of one set of events in the environment. Thus the influence of an electric discharge may, as lightning, reach Sammy's eyes and make him blink, and a little later as thunder, reach his ears and make him bolt.

But on several occasions I observed that *my* Sammy—a cocker spaniel—bolted (hid beneath my desk) at sight of the lightning-flash. This seems to imply fore-experience and affords an example of (3) the time-order of reference in the mind as perceptive. Here, in terms of time-order his behaviour forestalls the coming event. At sight there is behaviour which originally (as I believe) *followed* the sound; but on this later occasion it *precedes* the sound. There is thus reversal of time-order in mind through the intervention of fore-experience. What

happens, or has happened, in Sammy's body? We must in some way bring into relation the time-order of physiological processes in his body and the time-order of reference in his mind.

First let us notice that, in respect of reference, there has been a change of mental organization from Sammy (i) to Sammy (ii). On the interpretation here proffered there was, on some first occasion, for Sammy (i), sight, blinking; sound, bolting. But on some subsequent occasion there is, for Sammy (ii), sight, fore-sound, blinking-and-bolting. I regard this as a change from percipient organization in Sammy (i) to perceptive organization in Sammy (ii).

Thus I lead up to a re-statement of the question before us. That question is: What change in physiological organization is co-related with this change in mental organization? We want, if possible, an answer in such generalized terms as shall hold good for all particular or individual cases.

#### § 4

In the second section of this chapter I said something about the physiological organization of the body as co-related with an organization in mental awareness. We have now to concentrate attention on a specialized kind of organization, that of the nervous system, and, in our present context, that of a very highly specialized kind of nervous system technically called 'synaptic.' Here we may find what we seek—bodily concomitants of percipient and perceptive reference in relation to instinctive and intelligent behaviour co-related with awareness in behaving.

It is a complex business which I must try to reduce to its simplest expression. I ask leave, in the interest of brevity, to introduce a little *a b c* notation.

A synaptic nervous system consists of a multiplicity of nerve-routes. All of them (or those that here concern us) pass through the central nervous system, *c* (in our context the brain). Some of them carry waves of physiological change inwards from all parts of the body to *c*—the afferent routes *a*. Others carry waves outwards to all parts of the body—the efferent routes *e*. There is 'one-way' transmission—*a*, *c*, *e*.

We are here concerned with *a*, *c*, *e*, when *a* is from some sensory 'receptors', or group of receptors, to some 'effectors', or group of effectors, which excite the muscles whose orderly contraction or relaxation gives some responsive behaviour. But it should be noted that there are afferent waves from the muscles, tendon-sheaths, hinge-joints, eye-sockets, and so on; and that it is in large measure this afferent complex within the body, transmitted to the central nervous system, that is correlated with awareness in behaving.

Now my belief is that in instinctive behaviour every *a*, *c*, *e* is initially prescribed under the inherited organization of the nervous system, subject always to the physiological poise of the organism at the time being. If this be so, it gives us Blackie (i) in body-story.

But what we observe and record as an instance of instinctive behaviour is an enchainé sequence of behaviour-events, where each link in the chain is an *a*, *c*, *e*, and where the *e* of one link forms part of the complex which constitutes the *a* of the next link. Hence there is an enchainé sequence of *a*, *c*, *e*-links, in a meshwork which is often of bewildering complexity; in Pronuba, for example.

What then can one do? Is not the most promising course of procedure to disentangle from the bewildering complexity this or that enchainé thread in the meshwork; and then to trace its relations to some other thread?

Each thread ( $a$ ,  $c$ ,  $e$ -route), in Blackie (i) for example, is an instance of sensory stimulation (at  $a$ ) and behaviour response (consequent on  $e$ .) Both threads pass through  $c$ . But initially each thread is a prescribed route which just traverses  $c$  but is not inter-connected with the other.

Let two such prescribed routes in Blackie's nervous system be (1) a specialized sight-route with pecking as the response; and (2) a specialized taste-route with rejection as the response. Bear in mind that both sight-stimulation ( $s$ ), and taste-stimulation ( $t$ ), are specialized as modes of influence on retinal and gustatory receptors. In mind-story it is *this* visual situation; *that* nasty taste. So too the response is *this* pecking behaviour ( $p$ ), and *that* rejection behaviour ( $r$ ), *both initially prescribed*.

What one may call the 'rule of prescription' is: This stimulation gives this response; that stimulation gives that response. In my example: This  $s$  gives this  $p$ ; that  $t$  gives that  $r$ .

Thus far, we have prescribed routes passing through  $c$ . Thus far these routes are not inter-connected. Thus far we have Blackie (i).

Pardon some repetition. One must keep in touch with observation though one may introduce some symbolic shorthand. There is in Blackie (i): This  $s$ -route which runs through  $c$  to this  $p$ . But pecking entails seizing; and seizing entails tasting. Then we have: That  $t$ -route which runs through  $c$  to that  $r$ . So long, therefore, as the course of events is in accordance with the rule of prescription, *there is no 'cross-over' from this route to that*. Were Blackie (i) to remain Blackie (i) throughout life he would go on behaving in the *da capo* fashion to which I have already drawn attention (p. 144). He would exemplify the proverbial moth and candle situation.

But, under observation Blackie does not continue to behave on these instinctively *da capo* lines. He does not

remain B (i); he becomes B (ii). And as Blackie (ii) he rejects at sight that which as Blackie (i) he pecked at and seized at sight. *There is cross-over from this stimulation to that response.*

How are we to account for such cross-over if we interpret what presumably happens in terms of body-story—in terms of transactions within the central nervous system? Does it not seem likely that within (c) there is in some way established a ‘synaptic’ inter-connection between the originally prescribed sight-route and the taste-route no less originally prescribed? Is it not a working hypothesis that, at the cross-over switch-point, waves which start along the afferent limb of the sight-route proceed on their course along the efferent or effector limb of the taste-route? It is for those who know by heart body-story up to date to say whether this working hypothesis does work.

I here state the hypothesis in my own way; and I have said more about it elsewhere [*M.C.* Ch. V.]. I think it is in line with the large amount of evidence adduced by Dr. Pavlov and others in support of the ‘conditioned reflex’.

I cannot here discuss the matter further. This only will I add. I have dealt with just two *a*, *c*, *e*-routes in just one animal, Blackie. Dr. Pavlov and others have placed on record evidence in respect of a great number of pairs of *a*, *c*, *e*-routes in a great number of animals. As I read this evidence the conclusion to which I am led (stated in my own way) is this: Every conditioned response implies cross-over in a synaptic nerve-centre from ‘this’ prescribed route to ‘that’ prescribed route.

## § 5

If the Gentle Reader has borne with me so far, I surmise that he may still say: I do not quite see how



you correlate percipience in mind-story with your *a*, *c*, *e*-route in body-story; nor do I quite see how the 'fringe of futurity' in 'fore-experience' receives at your hands any helpful interpretation in body-story.

I must reply, as you doubtless wish, very briefly. Take the taste-route *t*, *c*, *r* in Blackie (i). I correlate this taste-route in body-story with taste-percipience in mind-story. The taste-route is initiated by receptors in the mouth; so we have the whole *t*, *c*, *r*, from start to finish. Concomitant therewith we have strong taste—actual taste—under stimulation of receptors.

Now turn to Blackie (ii) who rejects something at sight without actual tasting; that is, when the receptors in the mouth are not directly stimulated. In body-story there is not the whole route, *t*, *c*, *r*. There is only the part route *c*, *r*. But it is part of the whole taste-route which is, so to speak, tapped midway under cross-over. And (as I have urged again and again) under organic treatment the part partakes of the nature of the whole. Hence the part of the taste-route partakes of taste and takes form in perceptive mind-story as fore-taste—not only weak but *incomplete*, and therefore different, lacking the full flavour of taste. In this form I claim to be well acquainted with it as I raise to my lips a quinine-soaked rice-grain. I have taste-warning of that actual taste which is coming.

But, as fore-taste, it is a mode of reference with a fringe of futurity. In body-story there are no such relations as those which I speak of as 'reference', and there is therefore no fringe of futurity. Still less is there prospective reference in fore-plan.

Before raising the question: What may be the bodily accompaniment of a mental fore-plan? let me say a little more concerning the admittedly picturesque notion of cross-over.

Given an organism with a highly developed synaptic

nervous system (and such an organism is Blackie) there is provision for cross-over. But in Blackie (i) it is as yet no more than such inherited organization as provides for what may happen and in the natural routine of events does happen. In Blackie (i) the structural organization is such as to afford a very great number of prescribed routes from this stimulation to this response, or from that stimulation to that response, and so on; dozens of them in full orderly traffic within a few hours of hatching. Under such organization Blackie (i) acts instinctively. It is hard to assign definite limits to the extent of the inherited provision for his instinctive behaviour. Observation alone can enable us to say.

But in Blackie (i) the nervous system is also so organized that, when some 'this' route and some 'that' route are in traffic at the same time, a synaptic inter-connection between these two routes is opened up in such wise that there may be cross-over traffic from this stimulation to that response. When such cross-over occurs there is interlaced with the organization prescribed under inheritance a re-organization acquired in the course of individual life. The outcome of this instinctive organization, re-organized under cross-over traffic, is the intelligent behaviour of Blackie (ii).

Reduce this to its simplest terms in detail, and generalize in total net-result. Under reorganization there is provision for the linkage of *any* 'this' stimulation with *any* 'that' response within Blackie's repertory. Observation alone can enable us to say how far Blackie's intelligent behaviour takes him along the pathway of perceptive procedure.

It is, however, pretty clear that under re-organized traffic, with cross-over short-cuts, the time-order of events in the body need not be, and it often is not, the same as the time-order of events in the environment. Hence if awareness is co-related with events in the

body the time-order of awareness in the mind need not be, and it often is not, that of events in the environment. And since objective reference is correlative with awareness in perceiving, the time-order of reference to environing events may not be that of these events themselves. In that case there is fore-experience of coming events. And the outcome of this fore-experience is behaviour which forestalls these events.

If now you ask: What are the physiological conditions under which some behaviour is enhanced and other behaviour is inhibited?—if you ask: What actually happens at the synaptic switch-points of so-called ‘cross over’? if you want physiological details discussed in accredited terms—I must refer you to the physiologist, suggesting that you take no less pains to get at the net result of recent work on the integrative action of the nervous system and on the conditioned reflex than you doubtless take to get at the net result of recent work on the atom and on physical relativity.

## § 6

On the psychological evidence as I read it there came a stage of mental evolution—recapitulated in the individual development of those animals whose parents have reached this stage—when fore-experience dawned on the scene. It marks the passage from percipience to perception. It seems to be co-related in body-story with the evolution of a synaptic nervous system which affords provision for cross-over from one prescribed nerve-route to another.

But on the psychological evidence, as I read it, there came very much later in the course of natural events a further stage of mental evolution—likewise recapitulated in the individual development of those few animals whose parents have reached this stage—when fore-plans

of action dawned on the scene. This marks the passage from perception to reflection.

What body-story provision is there in the brain for that which takes form in Chica's mind, and in the mind of the child when he reaches the stage of reflection, as a fore-plan of action in view of anticipated events?

It may be that, as some believe, there is none. Many, however, believe that such there is though it is difficult for even the most expert neurologist to decipher it. They believe that in some part of the brain—probably in some highly specialized part of the 'neopallium' (Elliot Smith, 1901)—there is an organized pattern of nerve-routes in organic touch with subsidiary patterns in lower brain-centres; receiving afferent influence from all the conditioned responses; exercising differential influence on them, and through them on the behaviour they subserve.

If this, or something like this, thus briefly stated, be so; and if, on the psychological evidence up to date, it is, apart from men, only so in Chica and her cousins, we must start from *their* brains in body-story, for in them only is there such high-level organization. We must locate within their neopallium some specialized area in which, on due search, may be found what one may call a higher pattern which is in touch with a multiplicity of lower patterns.

We shall, under expert guidance, say that of Professor Elliot Smith, have to take into consideration the neurology of bionocular vision, such widespread brain-changes as are entailed by arboreal life, and much else—so much else that to say more on the topic here would carry us far beyond this glance at body-story. And it will lead us on from body-and-brain-story in apes to that in man; to its co-relation with mind-story in human folk; and thus to the crucial question: Is there in all living creatures *one* organization, that of body-mind, notwithstanding

that duality of relatedness which has led to their drastic separation as body *and* mind—entities that are said to belong, *au fond*, to wholly 'disparate' orders of being?

To this crucial question there are many who reply emphatically: No. There are others, not a few, who reply no less emphatically: Yes. Here is radical divergence in belief. But if these conflicting beliefs be honestly come by, may not members of each party respect that of the other, even if they are unable to share it? If they feel called on to enter into discussion, need either of them step down from the recognized platform of literary courtesy?

I am one of those who have been led to cast my vote with the Ayes. You, Gentle Reader, may have been led to cast your vote with the Noes. And as we walk away from the lobby arm in arm ere we part company at the close of the next chapter, I think you may say to me: My trouble is that you seem to deny that which we, on our part, deem essential—namely, a teleological explanation of life and mind; and that, if your body-story be seriously entertained and its implications fully accepted, there seems to us to be no escape from the conclusion that T. H. Huxley, outheralding Descartes, proclaimed from a British Association housetop: Animals are but conscious automata.

## CHAPTER XV

### *Are Animals Automata?*

#### § I

The Gentle Reader who knows his *Autocrat of the Breakfast Table* will remember the discussion concerning John and Thomas.

It seemed that there were three of the one and three of the other. There was the real John 'known only to his Maker'. There was John's notion of John, and Thomas's notion of John. Likewise there was the real Thomas; Thomas's notion of Thomas; John's notion of Thomas. No wonder that in argument there arises some confusion. "No wonder two disputants often get angry, when there are six of them talking and listening all at the same time."

And perhaps the Gentle Reader has some lurking sympathy with the practical application of these philosophical whimsies on the part of a John who sat near the Autocrat at table. From the basket of peaches going round he appropriated the three that remained, "remarking that there was just one apiece for him". "I convinced him, says the Autocrat, "that this practical inference was hasty and illogical, but in the meantime he had eaten the peaches." Illogical perhaps; but how characteristic of common-sense Johns!

Allow me to make this a peg on which to hang some recapitulation partaking rather of 'gossip' about the universe of mind. I too have urged that any mind, human or animal, is a real John or Thomas. I too believe that, in a liberal sense of the expression, this

real mind, as a whole, is known only to his Maker and therefore known only partially to himself. But this partial 'knowledge' reveals, so far as it goes, the real John or Thomas. For at any given moment, in any mind, at any stage of its development, there is what I have spoken of as first-hand experience—the current experience in that moment of the passing now. Here one may say that John's experience in that moment is the real John of that moment. Here we have Descartes' fundamental maxim reduced to the indubitable *Experientia est*.

But Descartes went a long way further than this. He said *Cogito ergo sum*. I am not going to discuss this maxim. Were I to do so I should ask: Even if we reduce this to the moment of experiencing and substitute *Sum cogitans*, did not Descartes mean more than 'I am experiencing'? Did he not mean 'I know (reflectively) that I am experiencing'? (p. 239). And what is the grammatical subject of the verb *sum*? Is it only the momentary John of the 'specious present'? Is it not rather an abiding John, either the real John or John's notion of John—his picture of John in the past (retrospectively) and in the future (prospectively)?

These questions, I think, are not *de trop*, if we presently substitute Carlo for John. Just now, however, some human John is on the *tapis*. And I take it that for the Autocrat not only the real John but John's notion of John is not a momentary but an abiding John. It is John's self in all the pictured situations in which John himself came into the picture. But this self—the self that he reflectively pictures—is an extraordinarily complex synthetic product of constructive thought. It is built up of a number of reminiscences and anticipations organically fused into a unitary whole. Hence this John, as the Autocrat says, "is never the real one, and often very unlike him".

Thus we have two Johns. And what is the Autocrat's third John? Is he not the John of imputation on the part of Thomas? Is he not the John that Thomas imputes to his neighbour? And have I not, in all that I have said on imputation, played the rôle of the Autocrat who said that *this* John is "never the real John, nor John's John, but often very unlike either"?

Since our topic is the animal mind we must now introduce Carlo—some dog who may accompany you, Gentle Reader, as John, and me, rather a doubting Thomas, on our walk through the field of animal psychology.

There is the real Carlo, of momentary and passing experience at any time during our walk. There is the mind that you and I respectively impute to Carlo. But, under *my* imputation, there is in his case no 'Carlo's notion of Carlo'. In *my* reading of his mind, he does not attain this level of reflective self-consciousness. In his case this Carlo is not on the *tapis*. None the less, even if we could perchance agree to eliminate this Carlo, there still remain on our hands three Carlos. There is the real Carlo we both want to get at; there is your version of Carlo; and there is my version of Carlo.

I have no wish to pile up the philosophical agony. But if, as our Autocrat has it, when you and I are discussing any topic 'there are six of us talking and listening', it seems that when we are discussing Carlo there are (further to complicate matters) three Carlos, yours, mine, and his Maker's. And if either of two disputants should say: My version of Carlo gives what he really is; that, alas, is what the other strenuously denies. And then the Autocrat of our breakfast table exclaims: "No wonder these disputants get angry." Unfortunately in too many discussions on the nature of mind, human and animal, the disputants do get



rather angry and very scornful. Opprobrious epithets envenomed with the bitter gall of controversy are slung to and fro. Says one: Still immured in the dungeon of mechanistic dogma. And the other retorts: Still an inmate of the animistic asylum for philosophical incompetence. 'Tis pity 'tis so; but so it is.

## § 2

In what follows let us try to put away anger, scorn, and all uncharitableness. I cannot know what may be your most cherished conviction with regard to mind, or, as I prefer to say, a mind. You may again and again have said *sotto voce*: This is not what I mean, at any rate not all that I mean, by a mind. This so-called relational treatment of a mind may be all very well in a way. It may be true enough so far as it goes; but I cannot believe that it is the whole truth. Here I agree. But have I not asked leave to limit our discussion to relational treatment? Let us briefly review the position.

A mind, as this word is used throughout our discussion, is an organic system of natural events which stand in a distinctive kind of relationship as parts within a whole. You then ask me: What is this kind of relationship? And here all I can say in reply is: That kind which is distinctive of a mind. It is a kind that I find in the world. It is the kind with which it is my province to deal.

This implies that I take the world as I find it. And this is the very point that calls for emphasis. In this discussion I am content to take it as I find it; and in this discussion I ask you to rest content to do so. I say: Let us take the world as given, and try to interpret it in terms of the relations which we are able to distinguish; such as temporal, spatial, physical, and, for

us above all, mental relations. And let us take the animals we find in the world as given. In their case too we find temporal, spatial, physical, and mental relations. Can we adequately interpret a single instance of animal behaviour if we leave out of account any one of these kinds? There they are; let us accept them as they are, and proceed with our task of interpretation.

If, however, in any given instance of animal behaviour, we say of these relations: There they are; let us not say of any one of them—for example the mental kind: There it is *apart from* the others; let us say: There it is *with* the others. If we do this it follows that when I speak of the mind of Carlo or of John I do not mean something apart from his body. I mean Carlo or John as he is in respect of such mental relations as obtain, realizing that there is also a body of Carlo or John in respect of such physical relations as also obtain.

The next thing I ask you to recollect is that a mind, like all things natural, has its history; the evolutionary history of successive generations of minds; the developmental history of each individual mind. And what this history discloses is progressive organization, part of and one with the organization of nature.

Now we get down to the crucial question which I suppose you to ask: Who or what organizes? But that question, and the answer that you or I may give to it, lies beyond the scope of discussion in this book.

You, Gentle Reader, may be a philosophical disciple of T. H. Green who postulated a Source of those relations which constitute nature. Or you may follow Henry Sidgwick who asked: "Why do the relations want a source? Why cannot they get on without one?" Or you may say: Some Source; some 'organizing principle'. Yes. But not *one* Source; two organizing principles; one for the organization of spatial and physical relations;

is yet more wonderful, the orderly advance of organization in the course of individual development. Even that is not all. More wonderful still is the preparatory organization at some earlier stage of development for that which will 'take effect' at some much later stage. Hundreds of examples may be adduced. For instance, I spoke (p. 247) of the inherited organization which 'provides for' such prescribed behaviour as is observable in Blackie (i) on the first occasion of sensory stimulation in eye or in mouth; provides, too, for that later cross-over which marks the passage to Blackie (ii).

Broadly speaking, one may say: The behaviour of any organism is an expression of its organization. The living animal lives forward under progressive organization through a series of stages each of which is preparatory to the next. Hence organization, bodily and mental, at an earlier stage affords provision for expression in behaviour at a later stage under appropriate internal excitation and external stimulation. Hence, too, given the requisite environmental conditions, and given progressive organization of his body-mind, there is in the fertilized ovum of Carlo provision for all his behaviour throughout life. That is in brief what we find in the progressive organization of Carlo. This takes us back to his parents and ancestors. All along the line there is provision in one generation for that which follows in the next.

The emphasis has fallen on *provision* in organization at some stage for that which occurs at a later stage. May one say that, throughout his life from birth and before birth till death, there is on Carlo's part *prevision*, at the earlier stage, of that which will occur at a later stage? Surely few will carry imputation to this length.

May one say, then, that Carlo's progressive organization is that of a teleological system? Only, I take it, under what I spoke of as transference. If it is a teleo-

logical system in the same sense as is a machine, it implies a teleological act on the part of its maker. Who, then, is its maker in the same sense as a man is the maker of a machine in accordance with his ends in view; that is, with design on his part? Some may say God; others may say Life; perhaps some may say: Nature made the atoms and molecules in Carlo's body; but then Life took up the running and carried matters much further; later on Mind took up the running and carried matters yet further. In any case the teleological act is on the part of the maker of the natural system called teleological under transference; on God's part; on Life's part; on Mind's part. Hence with T. H. Green one postulates an organizing source of the relations which are organized; whereupon Henry Sidgwick and others ask: "Why do the relations want a source? Why cannot they get on without one?"

Are we not led into deep and difficult waters? Is it unreasonable to say frankly that in this discussion of the animal mind I refrain from entering into them? That means that I take the organization of events in their relations as I find it. There the events are, however they came to be organized. Do I thus ignore teleological relations? I do not. I seek only to assign to them their due place *in a scheme of relational treatment*.

#### § 4

Waiving my preference for reserving the word 'teleological' to label those relations to prospective ends in view which characterize the reflective level of mental development, I defined teleological procedure as that which implies at least fore-experience on the part of those animals which have reached the perceptive level of mental development. Hence in instinctive behaviour

at the level of percipience there are no teleological relations.

Should we, then, speak of instinctive behaviour, say on some first occasion, as automatic; and of an animal, in so far as it behaves instinctively on all occasions, first and last alike, as an automaton?

That depends on the definition of the word 'automaton' which we accept. It may be so used as to include all animals but not humans (Descartes); or to include men also (Huxley). If then the Gentle Reader asks me: Are animals automata? I must ask him: What do *you* mean by an automaton?

He may say: Let us start with the Dictionary. Shall we then take Samuel Johnson's definition? It is: "A machine that hath the power of motion in itself, and which stands in need of no foreign assistance." Do you seek something more up to date. Turn, then, to the *Pocket Oxford Dictionary*. There you find: "Thing endued with spontaneous motion, e.g. living being; piece of mechanism with concealed motive power; person, etc., whose actions are purely mechanical." Here we had better look up *Spontaneous*. Thus it runs: "Resulting from natural impulse, not forced or suggested or caused from outside, instinctive or automatic." There follow secondary meanings.

I submit, Gentle Reader, that, in our context, these definitions, old and new, do not give us quite what we want. Dr. Johnson begins and ends with a machine. The *Pocket Oxford Dictionary* starts with an organism; proceeds with 'piece of mechanism', and concludes with a 'person, etc., whose actions are purely mechanical'. Under 'spontaneous' we have 'not caused from outside, instinctive or automatic'. But most instinctive behaviour with which I am acquainted is, partly at least, 'caused from outside', under stimulation of some sort. And if we turn elsewhere we are not much

better off. In the *Twentieth Century Dictionary*, for example, I find: "A self-moving machine, or one that moves by concealed machinery; a living being regarded as without consciousness; . . .; a human being who acts by routine, without intelligence." Here we have, to start with, 'machine' again; to end with, 'by routine, without intelligence'. Would not M. Bergson add 'or mechanically'? Between these we have 'regarded as without consciousness'.

'Without consciousness' is, as we have seen, ambiguous. My belief is that the animal that behaves instinctively is subconscious. There is some urge; percipience; awareness in behaving; affective tone. In common parlance he is pretty vividly 'conscious'. I have suggested that there is mind (or mental relatedness) at three levels; sub-conscious at the percipient level; conscious at the perceptive level; self-conscious at the reflective level. But in current speech we use the word 'conscious' at all three levels.

All our dictionary definitions lay stress on 'machine', on 'mechanism', on 'purely mechanical'. I shall presently try again to emphasize my belief and my reiterated contention that a living organism is not a machine; that its manner of go is not only mechanical; that a so-called mechanistic theory of organisms is no longer tenable; and that if the word 'automaton' be so taken as to imply such a mechanistic theory, the answer to the question: Are animals automata? is: No, they are not automata even when their behaviour is instinctive.

It may, however, be said that if a physiological interpretation of the animal's body-story be accepted, and if a mind-story be merely 'concomitant' or 'co-related' therewith, it is futile to contend that such a doctrine is other than mechanistic in the common acceptance of this word.

I surmise that some Gentle Reader may say: This is a matter in which we are interested. They may ask: Is this so? We expect you to say something more—neither too much nor too erudite—on Descartes' notion of the automatism of brutes and on Huxley's defence of the conscious automatism of animals and men. What did they mean? How much of it will now pass current as the coin of modern thought?

## § 5

First with regard to Descartes. Translated into my own terms his cardinal contention was that animals are, at most, perceptive only whereas man is reflective also. That was his reading of mind-story. If we turn to his reading of body-story there is no doubt much that sounds strange to modern ears. It is scarcely going too far to say that wherever his physiology and his embryology may be put to the test in detail he went pretty badly astray. And yet he did take unusual pains to come into observational touch with the facts. In any case he was led to the belief that a body-story there is—one which should be told in relational terms no less physical in kind than those in which the working of a machine are discussed. This body-story he believed to be applicable to all animals and to man in respect of his animal nature.

There he drew the line. Beyond the 'conarium' or pineal gland there is, in man, the rational soul. We pass behind that which is naturally organized, as we now say, to a partaker in the supreme activity of organizing. Still, even in man much that he does, perceives, and feels, is interpretable in terms of that which is already relationally organized and requires no intervention of the rational soul. That is the nature that man shares with animals.

He describes it in the oft-quoted summary at the close of the *Traité de l'Homme*. It includes reference to sensory qualities, to imagination, to the retention of ideas in memory, to appetites and passions. It includes that which I have spoken of as conscious and sub-conscious. It excludes that which I have spoken of as self-conscious. Hence mind-story is excluded only in so far as it is identified with reflection and with thought. This is lacking in animals. None the less such mind-story is imputed to them as falls under perception. Descartes speaks of "All that can be taught to animals by acting on their hopes and fears of bodily pleasure and pain, which is the principle of all training in animals"; and he says that "dogs express to us their passions so well, that they could certainly express their thoughts if they had any".

There are, no doubt, ambiguous passages in his writings. But I think that by such expressions as 'bodily pleasure and pain' Descartes meant bodily processes with mental accompaniments. Even so he desires that we should "consider that its functions follow quite naturally in the machine from the mere arrangement of its organs, neither more nor less than do the movements of a clock, or other automaton, from that of its weights and its wheels". Here the emphasis falls on the words 'quite naturally'. Therein lies their sting.

## § 6

Some 230 years after Descartes had stated his thesis concerning the automatism of brutes, and even of man apart from the infusion of rational thought, T. H. Huxley took up the cudgels in its defence. Meanwhile the waters of evolution—epigenetic evolution—had flooded the field of inquiry. So, as evolutionist, Huxley says that very strong arguments would be needed to convince him that such a complex phenomenon as



reflective self-consciousness came into existence suddenly, and made its first appearance in man. Hence he included men also under 'conscious automata'.

Much of the Belfast Address (1874) was on body-story—on Descartes' seventeenth-century physiology reviewed by an expert in the light of fuller knowledge up to date. But it is with mind-story that we are chiefly concerned. What, then, does Huxley say with regard to mind-story?

It is not easy to state in half as many lines the gist of what lies embedded in fifty pages. Let me try. First he says, in effect, that though mind-story is always concomitant with, or consequent on, body-story, there is much body-story which is only indirectly connected with mind-story; the direct connection is between mind-story and brain-story, or some part of brain-story. Then he says that, though there is this connection, the so-called 'events' recorded in mind-story (such as perception and desire) have no effect on the course of events recorded in body-story.

The animal lives in a world of physical events. The events in his body and brain are just those physical world-events which are inside his skin; and that is all the difference in *kind* that there is between them and the events that are outside his skin. This, in brief, is the world-story of which body-story is the part that lies within the living organism. But in the brain-part of this body-part of world-events there is concomitance. If so, does it not follow that we have to reckon also with mind-events? Not so, says Huxley. In strictness there are no mind-events. What we call mind-events are only *symbols* of world-events; and as symbols only they play no part in the world-game—no more part than does the sound of a bell in the fall of the clapper; no more part than does the steam-whistle in the running of the engine.

Huxley thus far invites us to believe that animals, at their perceptive best are no more than conscious automata. And since such perception as we may impute to them is symbolic only, it can make no difference in their automatic behaviour. Should Tony bark for a biscuit, this too is only symbolic. It is an outcome of his behaviour which somehow influences my brain; but it is like the automatic striking of a clock which is so constructed as to 'tell the time'. It merely expresses his physiological state. It no more influences what he does than the ringing of the chimes has effect on how the clock goes.

It seems, then, that the events recorded in body-story, as part and parcel of the events recorded in physical world-story, are the only events that really count. Their symbols in mind-story count not a whit.

This doctrine of symbolism may be regarded by New Realists as radically unsound doctrine. A colour or a sound, it may be said, as given in percipient reference, is not only a symbol of other and unlike events in the physical world. It reveals under direct apprehension the real character of these physical events. That question need not here be discussed. We are dealing with Huxley; let us do so on his own terms. Let us grant that, on these terms, taste in Blackie is merely symbolic of certain chemical properties of quinine. But what about fore-taste?

Bear in mind the evidence I have adduced which leads me to impute fore-taste to Blackie. On several occasions he pecks at quinine-soaked rice-grains. Thereafter he behaves towards plain-boiled rice-grains as if they were quinine-soaked. In this case fore-taste is symbolic of chemical properties *which are not there*. And this symbolism seems to count in Blackie's behaviour. The symbolism of fore-experience seems to count in all intelligent behaviour at the perceptive level

of mental development. Tony barks for biscuit with fore-experience of getting it. This time-factor in the order of symbolism is that which, as at present advised, I am unable to square with Huxley's doctrine of conscious automatism. The time-order of the symbols in consciousness is different from that of the external world-events which are symbolized.

Revert to the dictionary definition of an automaton—a 'machine' that does so and so. It is so constructed as to do so and so. Well, I set to work to construct an automatic chick. Had I adequate skill I fancy I could make one with a photographic eye and a chemically sensitive palate. I fancy that I could so arrange matters that the photographic eye would start rather complex machinery by which my automaton would begin with a shuffle forwards and end with a peck; and so arrange matters that the chemically sensitive palate would start another lot of machinery which makes the chick engulf a plain-boiled rice-grain and drop with an automatic shake of the head a quinine-soaked rice-grain; perhaps, by some additional mechanism, wipe its bill on the ground. But I do not see how I could so arrange matters that my automaton could act as a living chick acts, in suchwise as to lead me to say: Here is an automaton with fore-experience of what is coming in the course of an orderly routine but has not yet come.

It may be said, however, that there is in the living chick such bodily organization, under cross-over or otherwise, as to provide for what actually happens, including fore-taste or other fore-experience. That I do not deny. It is my belief that there is a body-story co-related with mind-story. What I submit is that in any perceptive mind-story those mental relations which are comprised under fore-experience are no less effective than are those physiological relations which Huxley was concerned to emphasize in his Belfast Address.

## § 7

To the definition of an automaton as a machine which stands in need of no foreign assistance, Dr. Johnson adds, in illustration of the use of the word, a (condensed) quotation from Joseph Glanvill in the Address to the Royal Society which forms the Preface to his *Scepsis Scientifica* (1665). Thus it runs: "'Tis a greater credit to understand the Art whereby the Almighty Wisdom governs the Motions of the great Automaton than to have learnt all the intrigues of Policy."

Some may find difficulty in squaring the foregoing definition of the word with this illustration of its use. But may we not leave all questions concerning the governance by Almighty Wisdom to be discussed under the heading of Theology? It may be said that this excludes all reference to teleology. No doubt it may if we accept as a definition of teleology a 'Doctrine of Final Causes', of which, as 'a piece of nursery teleology', the *Pocket Oxford Dictionary* gives, in illustration, "that holly-berries are abundant in hard winters lest the birds should starve".

I am not alone in contending that, in any treatment which purports to be *scientific*, a doctrine of final causes lies wholly outside its purview. So I distinguish *this* definition of teleology from that which I have given above (p. 256) with reference to those acts which imply an end in view on the part of some human being, or perhaps some animal, who has reached the reflective level of mentality.

Thus we are led back to such a system of events as may be called teleological under transference of attention from act to outcome (p. 257). As outcome it implies the act of a reflective being who is also perceptive and percipient; in whom a body-story is co-related with mind-story; in whom there is in the one story develop-

ment from percipience to reflection, in the other story embryological advance and consequent changes of organization from birth to death.

If, then, one deals with some system on the hypothesis that it is a teleological system, and proceeds to submit this hypothesis to the test—if one says: It looks as if this outcome implies an end in view on the part of some reflective being; and if, on further investigation, one is led to say: Yes, I believe that this outcome *does* accord with a precedent end in view on the part of some reflective being—even so it still remains to ask: What reflective being, say Chica or another? and, Under what modes of mental and physical relatedness?

We may work back, for example, from Sultan's double-stick to his end in view in contriving it. We do not go beyond the relational situation. Once more I seek to keep within bounds; to keep to Sultan in his cage, with his bamboo double-stick by means of which he hopes to reach his objective and attain that outcome which was his precedent end in view.

I take it that we may regard the double-stick as, so far as it goes, a piece of mechanism and as, thus far, affording an example of a machine, or at least of a tool made and used with design. On these terms I venture to say that any tool and any machine that works as a piece of mechanism is a teleological system which, as outcome, accords with a precedent end in view on the part of some reflective being, human or subhuman, whose design it embodies. And then I go a step further and venture to say, on these terms, that no living creature is a machine. A living animal is not a teleological system. It is not the outcome of such acts as imply an end in view on the part of a human being, or perhaps some animal, who has reached the reflective level of mentality. Nor is it an automaton. What, then, is it? It is an organism.

An automaton is a manufactured article. No organism is a manufactured article—I need hardly repeat the reiterated proviso—"so long as it is discussed in those relational terms which are appropriate to scientific treatment".

I find no grounds for the belief that the most cunning and skilful of men has succeeded in making an organism, living *or other*, though he can make machines within which organisms are utilized as part of the mechanism. I here use the word 'organism' in the extended sense which embraces atoms and molecules. It may then be said: Surely the chemist can make, and has made, new molecules. Yes, in a loose sense. But only in the sense that he can so arrange matters that under certain conditions, which he provides with this end in view, the new molecules just come into being. Until he has learnt what these conditions are, the molecules do not come into being. Nor does any living organism come into being save under those conditions which we speak of as the orderly course of nature, which as many have been led to believe is that of progressive organization subject to that canon of interpretation which I have spoken of as the organic principle.

What, then, about Huxley's contention that animals are conscious automata? It must, I think, nowadays, be revised in the light of the organic principle. The automatism for which he contended was just purely natural organization. As such it was in no relational sense teleological. The pupil may differ from his honoured master as to the effective part which mental relations have played in the advance of world-events; he may descry in that progressive advance orderly steps which may be described as emergent; but when the stress falls on natural organization, my small voice does but echo his trumpet call.

## § 8

Just a few more words before I bid the Gentle Reader farewell. Take three 'things': a rounded pebble from the sea-beach; a billiard ball; an egg from the roe of a herring. Each is approximately spherical in shape. How does each get this shape? The pebble under purely mechanical conditions, impact from other pebbles, and so on; the billiard ball under the design of the turner; the egg as an expression of organization. The first is a mere thing; the last is far more than a thing; it is an organism. Neither of these is a teleological system. The billiard ball is a teleological system. It is shaped to order with an end in view on the part of some human artificer. And that artificer is more than a mechanical thing like a pebble; more than an ovum as an organism; more than the herring that in due course of nature commits her eggs to the waters. He is an organism that has reached the status of a reflective human being.

You may well ask whether that is the end of the story; whether organic systems, mechanical systems, teleological systems, have not some further significance.

I believe that they have, one and all. None the less, that is the end of my story in this book. In the telling of it I have been led far afield. But that, says Mr. Crothers, from whom I took my cue in the Preface, is what the Gentle Reader likes.

I have sought to render comprehensible, though perhaps not acceptable, that point of view to which I have been led. But that, too, is what the Gentle Reader may like—so long as it discloses 'a real point of view and not a smudge'. What the Gentle Reader objects to, says Mr. Crothers, is "the historian who takes both sides in the same paragraph. That", he adds, "is what I call offensive bi-partizanship."

My attitude in writing has not been: "Go to, now, I will produce a masterpiece"; whereupon the Gentle Reader feels that he must be conscientious and says, with resignation: "Very well; I can stand it. I will apply myself with all diligence." Such diligence savours of the academic class-room.

I have tried to bear in mind that the Gentle Reader assures Mr. Crothers: "I am not a student, nor is this a schoolroom. It's all in confidence; speak out as one gentleman to another, under a friendly roof! What do you think about it? No matter if you make a mistake or two. I'll forget most that you say, any way. All that I care for is to get at the gist of the matter. As for your fear of warping my mind, there's not the least danger in the world. My mind is like a tough bit of hickory; it will fly back into its original shape the moment you let go."

And so confidences have been interchanged; there has been gossip about the Universe, and suggestions—or perhaps the Gentle Reader will prefer to say personal revelations—concerning the queerness of human nature, and, he may add, not a little queerness imputed to the Animal Mind.





## Index

- Action and knowledge, 14, 16  
 Adornment, 88, 97, 224  
*Æsop* prawn, 222 f.  
 ALEXANDER, Professor S., quoted, 15  
 ALLEN, Dr. E. J., 227  
 Ancestral memory, 127, 205  
 Anticipation, 191, 194  
 Apprehension, direct, 32  
 ARGYLL, Duke of, quoted, 51  
 Association, 151 ff.  
*Autocrat of the Breakfast Table*, 251 ff.  
 Automaton, 260, 269  
 AVEBURY, Lord, quoted, 163  
 Aversion of gaze, 145  
 Awareness, 28, 40, 214, 239  
 Behaviourists, 72  
 BERGSON, Professor Henri, 164, 261  
 BETHE, Herr, quoted, 57  
 Bird migration, 229  
 Blind and ignorant present, 125, 141  
 Body-story and mind-story, 222 ff., 229  
 BRANDAM, Charles, 194  
 BROWNING, Robert, quoted, 43  
 BUDGETT, J. S., 109  
 CANNON, Dr. W. B., quoted, 236 f.  
 Canon of interpretation, 22, 227  
 CARLYLE, Thomas, quoted, 83, 209  
 Chimpanzee, 86 ff., 201 ff.  
 Common-sense belief, 34  
 Conditioned reflex or response, 245, 248  
 Conscious, sub-conscious and self-conscious, 58, 195, 261  
 Co-operative building, 86  
 'Cross-over', 11, 245 ff.  
 DARWIN, Charles, quoted, 1  
 DESCARTES, 40, 252, 262  
 Desire, 125  
 DEWEY, Professor John, on *How we think*, 170  
 Discrimination, 183, 232  
 Dogs crossing stream, 9  
 Edgell, Professor Beatrice, *Theories of Memory*, 189, 199  
 Eels and elvers, 225 ff.  
 Effective relations, 72  
 Endocrine glands, 236  
 Enjoyment, 201  
 Environment, 67  
 Epigenesis, 69  
 Evolution, 68  
 Expression and impression, 96, 100, 196, 224  
 Field naturalist, 135  
 Final causes, 267  
 Finding and seeking, 119, 140  
 First-hand experience, 27, 34 ff.  
 Flight in birds, 105, 120  
 Food-line of advance, 142  
 Fore-experience, 142, 150, 159, 212, 218, 233, 256, 266  
 Fore-plan, 7, 13, 47, 85, 171  
 Fore-taste, 146, 148  
 Fringe of futurity, 159, 171, 212, 240, 246  
 Fringe of spatiality, 218

- GAMELE, Professor, quoted, 224  
 Gestalt theory, 143, 165, 178  
 GLANVILL, Joseph, quoted, 267  
 GOULD, Sir F. C., *Nature Caricatures*, 79  
 Grebe, courtship of, 92  
 GREEN, T. H., 255, 259  
 GRINDLEY, Mr. G. C., quoted, 166  
  
 Habit, 179  
 HAMERTON, P. G., quoted, 81, 209  
 HENDERSON, Professor L. J., quoted, 67  
 Hesitation, 183  
*Hippolyte*, 223  
 HOFFDING, Professor, quoted, 153  
 Hormones, 236  
 HUC and GABET, as quoted by Hamerton, 81  
 HUDSON, W. H., quoted, 90  
 HUME, David, quoted, 151  
 HOWARD, Mr. H. Eliot, 110, 124, 235, 237  
 HOWARD, Mr. H. F., 106  
 HUTCHINSON, Colonel, 1, 22, 24, 25  
 HUTCHINSON, Mr. Horace, 2, 22, 25  
 HUXLEY, Professor Julian, 92, 95, 102  
 HUXLEY, T. H., *aff. ff.*  
  
 Ignorance of animals, 82, 208 ff.  
 Imitation, 109, 121  
 Impression and expression, 96, 100, 196, 224  
 Imputation, 24, 31, 40  
 Individuality, 140  
 Inheritance of acquired habit, 182  
 Insight, 46, 86, 171, 178  
 Instinctive behaviour, 50, 101, 129, 144  
  
 Internal secretions, 236  
 Intelligent behaviour, 101  
 Introspection, 35  
  
 JAMES, William, 159  
 JENNINGS, Dr. H. S., 231 ff.  
 JOHNSON, Samuel, 260, 267  
  
 Kluge Hans, 162  
 Knowledge and action, 14, 16  
 KÖHLER, Professor W., *Mentality of Apes*, 47, 73, 84, 86 ff., 98, 171, 201  
  
 Lapwing, 235  
 Lapwing, spur-winged, 91  
 Learning, 117 ff.  
*Lissopimpla*, 55  
  
 MAETERLINCK, M., 49, 50, 56  
 McDUGALL, Professor W. quoted, 180  
 Mechanical relations, 66  
 Megapode, 107  
 Memory, 187 ff.  
 Merganser, 51  
 Micro-organisms, 233  
 MILL, James and John Stuart, 153, 154  
 Moor-hen, 104, 107  
*Motion-patterns*, 87  
 MUKERJI, Dhan Gopal, on elephants, 78  
  
 Neopallium, 249  
 Nest-building, 109  
 Noddy Tern, 229  
  
 Onward Association, 166  
 Orang-utan, 84, 178  
 Organic principle, 66, 114, 128, 154

- Organism, 63 ff.  
 Organization, 65, 258  
 Outcome of behaviour, 46  
  
 'Pandora' quoted, 78  
 Part-whole relationship, 65  
 PAVLOV, Professor, 245  
 Percipience, 23, 40, 44  
 Performing animals, 160 ff.  
 Philosophy and science, 33, 36, 71  
 Picture of future and past, 212, 240  
 Pigmy hippopotamus, 221  
 Plain tale, 221 ff.  
 Pollack, 227  
 Prescribed nerve-routes, 243  
*Pronuba*, 50 ff.  
 Provision and prevision, 258  
 PYCRAFT, Mr. W. P., *Courtship of Animals*, quoted, 92 ff.  
  
 Racial retentiveness, 206  
 Rat and maze, 169 ff.  
 Rat and tank, 180 ff.  
 Receptacle-notion of memory, 187  
 Reference, 26  
 Reflective and unreflective procedure, 37, 170, 213  
 Reflex action, 130 ff.  
 Relatedness, 34, 38, 60  
 Remembrance, 190, 194  
 Reminiscence, 192  
 Renewal and revival, 158  
 Retentiveness, 190, 193, 204, 207  
 Retriever, 1  
 Retrospection, 190, 197  
 Reversal of behaviour, 236  
 Reversal of time-order, 241, 247  
 Reverse association, 166  
 RICHARDSON, Miss Josephine, quoted, 77  
 RICHARDSON, Colonel, 17, 20  
 ROMANES, G. J., quoted, 132  
 Rudd, 227  
  
 Science and philosophy, 33, 36, 71  
 SHELLEY, P. B., quoted, 157  
 Sheep-dog, 3  
 SIDGWICK, Henry, 255, 259  
 Skill in flight, 122, 124  
 SMITH, Professor Elliot, 249  
 Space-plan, 215  
 Specious present, 211, 213, 219, 256  
 Spur-winged lapwing, 91  
*Stenor*, 231 ff.  
 Storage of memories, 198  
 STUMPF, Professor, quoted, 162  
 Sympathy, dramatic, 77  
 Synaptic nervous system, 242 ff.  
  
 Teaching, 120, 123  
 Teleology, 256 ff.  
 Thibetan cow, 81  
 Things, mere, 66  
 THORNDIKE, Professor, 173; quoted, 174  
 'Through reflective spectacles', 210, 215, 217  
 Time-order of events, 241  
 Time-plan, 199  
 Trail of the past, 212, 240  
 Transformed world, 215, 217  
 Trial and error, 169 ff.  
  
 Unreflective and reflective procedure, 37, 170, 213  
 Urge, 75, 113  
  
 WAGNER's use of association in 'motif', 156  
 WATSON, Dr. J. B., 229  
 WEIR, Jenner, quoted, 109  
 WHITMAN, Walt, quoted, 77  
 Whole, more than sum of parts, 64  
  
 YERKES, Professor, quoted, 47, 85, 178  
 Yucca, fertilization of, 50 ff.



A SELECTION OF  
Messrs. Edward Arnold & Co.'s  
Scientific & Technical Publications

---

**PHYSICS**

**GENERAL ASTRONOMY.** By H. SPENCER JONES, M.A., Sc.D., H.M. Astronomer at the Cape. viii + 392 pages, with 102 diagrams and 24 plates. **THIRD IMPRESSION.** Demy 8vo, 21s. net.

**THE LIFE OF LORD RAYLEIGH.** By his son, ROBERT JOHN STRUTT, Fourth Baron Rayleigh, F.R.S. Demy 8vo, xii + 403 pages. 25s. net.

**ISOTOPES.** By F. W. ASTON, Sc.D., D.Sc., F.R.S., Nobel Laureate, Fellow of Trinity College, Cambridge. viii + 182 pages, with diagrams and plates. **SECOND EDITION.** Demy 8vo, 10s. 6d. net.

**IONS, ELECTRONS, AND IONIZING RADIATIONS.** By J. A. CROWTHER, M.A., Sc.D., Professor of Physics at the University of Reading. **FIFTH EDITION.** Thoroughly revised. xii + 353 pages. Demy 8vo, 12s. 6d. net.

**THE DYNAMICAL THEORY OF SOUND.** By HORACE LAMB, Sc.D., F.R.S., Rayleigh Lecturer in the University of Cambridge. **SECOND EDITION.** viii + 307 pages. Demy 8vo, 18s. net.

**SOUND. A Physical Textbook.** By E. G. RICHARDSON, M.Sc., Ph.D., Assistant Lecturer in the Physics Department, University College, London. viii + 286 pages, with 86 illustrations. Demy 8vo, 13s. net.

**THE ACOUSTICS OF ORCHESTRAL INSTRUMENTS AND OF THE ORGAN.** By E. G. RICHARDSON, M.Sc., Ph.D. Demy 8vo, 160 pages, with 20 plates, 10s. 6d. net.

**AN INTRODUCTION TO THE THEORY OF OPTICS.** By Sir ARTHUR SCHUSTER, Sc.D., F.R.S. **THIRD EDITION.** Revised by the Author and J. W. NICHOLSON, D.Sc., F.R.S., Fellow and Tutor of Balliol College, Oxford. xvi + 405 pages, 188 illustrations. Demy 8vo, 18s. net.

**LECTURE EXPERIMENTS IN OPTICS.** By B. K. JOHNSON. 112 pages, with 87 diagrams. Demy 8vo.

**COLOUR VISION. A Discussion of the Leading Phenomena and their Physical Laws.** By W. PEDDIE, D.Sc., F.R.S.E., Harris Professor of Physics at University College, Dundee. xii + 208 pages. Demy 8vo, 12s. 6d. net.

**MOLECULAR MAGNETISM.** By W. PEDDIE, D.Sc., F.R.S.E. Demy 8vo. viii + 140 pages, with 38 diagrams. 10s. net.

**AERONAUTICS IN THEORY AND EXPERIMENT.** By W. L. COWLEY, A.R.C.S., D.I.C., and H. LEVY, M.A., D.Sc., F.R.S.E. **SECOND EDITION.** xii + 332 pages. Demy 8vo, 25s. net.

**A TEXT-BOOK OF PHYSICS.** By R. S. WILLOWS, M.A. (Camb.), D.Sc. (London). **THIRD EDITION.** viii + 520 pages, with 320 diagrams. Large crown 8vo, 9s.

**THE PRINCIPLES OF PHYSICS. A Textbook for Students of Pharmacy.** By C. J. SMITH, Ph.D., D.I.C. Crown 8vo. viii + 288. pages 9s.

**AN INTRODUCTION TO FLUID MOTION.** By W. N. BONN, D.Sc., F.Inst.P., Lecturer in Physics at the University of Reading. Crown 8vo, 5s. net.

---

LONDON : EDWARD ARNOLD & CO., 41 & 43 MADDOX ST., W.1.

- HEAT.** By W. J. R. CALVERT, M.A., Harrow School. viii + 344 pages, with 138 diagrams. Crown 8vo, 6s.
- LIGHT.** By F. BRAY, M.A., late Science Master at Clifton College. xvi + 284 pages, with 234 diagrams and 6 plates. Crown 8vo, cloth, 6s.
- ELECTRICITY AND MAGNETISM.** By C. E. ASHFORD, M.A., Headmaster of the Royal Naval College, Dartmouth. With over 200 diagrams. THIRD REVISED EDITION. Crown 8vo, 4s. 6d.

## MATHEMATICS

- FIVE-FIGURE TABLES OF MATHEMATICAL FUNCTIONS.** By J. B. DALE, M.A., Assistant Professor of Mathematics at King's College, London. Demy 8vo, 4s. 6d. net.
- LOGARITHMIC AND TRIGONOMETRIC TABLES (To Five Places of Decimals).** By J. B. DALE, M.A. Demy 8vo, 2s. 6d. net.
- THE CALCULUS FOR ENGINEERS.** By JOHN PERRY, M.E., D.Sc., F.R.S. THIRTEENTH IMPRESSION. viii + 382 pages. Crown 8vo, 8s. 6d.
- CALCULUS FOR TECHNICAL STUDENTS.** By S. N. FORREST, M.A., B.Sc. Crown 8vo, viii + 231 pages, 5s.
- CALCULUS FOR SCHOOLS.** By R. C. FAWCETT, M.A., Head of the Military and Engineering Side at Clifton College; and C. V. DURELL, Senior Mathematical Master at Winchester College. Crown 8vo. With Answers. In one volume, 6s. 6d. Part I, 3s. 6d.; Part II, 4s.
- AN INTRODUCTION TO PROJECTIVE GEOMETRY.** By L. N. G. FILON, M.A., D.Sc., F.R.S., Professor of Applied Mechanics, University College, University of London. THIRD EDITION. viii + 261 pages. Crown 8vo, 7s. 6d.
- HIGHER ALGEBRA.** By W. P. MILNE, M.A., D.Sc., Professor of Mathematics in the University of Leeds. xii + 586 pages. Crown 8vo, 8s. 6d.
- HOMOGENEOUS CO-ORDINATES.** By W. P. MILNE, M.A., D.Sc. xii + 164 pages. Crown 8vo, 6s. net.

## ENGINEERING

- BRITISH ENGINEERING WAGES.** By R. SPICER. Demy 8vo. 160 pages. 10s. 6d. net.
- THE STRENGTH OF MATERIALS. A Treatise on the Theory of Stress Calculations for Engineers.** By J. CASE, M.A., F.R.Ae.S., Lecturer in Applied Mechanics at the Royal Naval Engineering College, Keyham Med. 8vo. viii + 558 pages. 30s. net.
- STRENGTH AND STRUCTURE OF STEEL AND OTHER METALS.** By W. E. DALBY, F.R.S., M.A., B.Sc., M.Inst.C.E., M.I.M.E., University Professor of Engineering at the City and Guilds (Engineering) College. Very fully illustrated. 192 pages and 38 plates. Medium 8vo, 18s. net.
- STEAM POWER.** By Professor W. E. DALBY, F.R.S., M.Inst.C.E., M.I.M.E. SECOND EDITION. xvi + 760 pages, with 250 diagrams. 8vo, 25s. net.
- VALVES AND VALVE GEAR MECHANISMS.** By Professor W. E. DALBY, F.R.S. xviii + 366 pages, 202 illustrations. Royal 8vo, 24s. net.
- THE BALANCING OF ENGINES.** By Professor W. E. DALBY, F.R.S. FOURTH EDITION. xii + 321 pages, 218 illustrations. Medium 8vo, 21s. net.
- PROPERTIES OF STEAM AND THERMODYNAMIC THEORY OF TURBINES.** By H. L. CALLENDAR, F.R.S., Professor of Physics in the Imperial College of Science and Technology. 544 pages, numerous diagrams. 8vo, 30s. net.

LONDON: EDWARD ARNOLD & CO., 41 & 43 MADDOX ST., W.1.

**THE ENLARGED CALLENDAR STEAM TABLES.** (Fahrenheit Units.) 7s. 6d. net.

**THE CALLENDAR STEAM TABLES.** 3s. 6d. net.

**ABRIDGED CALLENDAR STEAM TABLES.** (Centigrade Units.) SECOND EDITION. 8vo, 1s. net.

**ABRIDGED CALLENDAR STEAM TABLES.** (Fahrenheit Units.) SECOND EDITION. 8vo, 1s. net.

**THE MOLLIER DIAGRAM.** Drawn by Professor CALLENDAR and printed on green squared paper. 1s. net.

**THE ENLARGED MOLLIER DIAGRAM.** Drawn by Professor CALLENDAR. Printed in three colours on squared paper. 4s. net.

**THE CALLENDAR STEAM DIAGRAM.** (Centigrade Units.) 6d. net.

**THE CALLENDAR STEAM DIAGRAM.** (Fahrenheit Units.) 6d. net.

**HEAT DROP TABLES; ABSOLUTE PRESSURES.** Calculated by H. Moss, M.Sc., A.R.C.S., from the Formulæ and Steam Tables of Professor H. L. Callendar, F.R.S. 64 pages. Cloth, 5s. net.

**HEAT DROP TABLES; H.P. GAUGE PRESSURES, L.P. ABSOLUTE PRESSURES.** Calculated by H. Moss, Imperial College of Science, from Professor Callendar's Formulæ and Steam Tables. Cloth, 5s. net.

**THE ENLARGED HEAT DROP TABLES; H.P. GAUGE PRESSURES, L.P. ABSOLUTE PRESSURES.** 10s. 6d. net.

**CORRECTION TABLES FOR THERMODYNAMIC EFFICIENCY.** Calculated by C. H. NAYLOR, Assoc.M.Inst.C.E. Cloth, 5s. net.

**ELECTRICAL SUBSTATIONS.** By H. BRAZIL, M.I.E.E. 224 pages, with 56 illustrations. Demy 8vo, 12s. 6d. net.

**RAILWAY ELECTRIC TRACTION.** By F. W. CARTER, Sc.D., M.I.E.E., M.Inst.C.E., British Thomson-Houston Co., Rugby. viii + 412 pages, with 204 illustrations and 10 folding plates. Demy 8vo, 25s. net.

**ELECTRIC TRAINS.** By R. E. DICKINSON, B.Sc., A.M.I.E.E. xii + 292 pages, with 139 diagrams. Demy 8vo, 16s. net.

**THE PRACTICE OF RAILWAY SURVEYING AND PERMANENT WAY WORK.** By S. WRIGHT FERROTT, M.A.I., M.Inst.C.E., and F. E. G. BADGER, A.M.Inst.C.E. viii + 304 pages, with 140 diagrams. Demy 8vo, 30s. net.

**THE ECONOMICS OF RAIL TRANSPORT IN GREAT BRITAIN.** By C. E. R. SHERRINGTON, M.A., A.M.Inst.T., London School of Economics. Vol. I, History and Development. Vol. II, Rates and Service. Demy 8vo, 12s. 6d. net each volume.

**THE MEASUREMENT OF FLUID VELOCITY AND PRESSURE.** By the late J. R. PANNELL. Edited by R. A. FRAZER, B.A., B.Sc., National Physical Laboratory. viii + 138 pages. 10s. 6d. net.

**HYDRAULICS.** For Engineers and Engineering Students. By F. C. LEA, D.Sc., M.Inst.C.E., Professor of Mechanical Engineering in the University of Sheffield. FIFTH EDITION. About 750 pages and 550 diagrams. Demy 8vo.

**ELEMENTARY HYDRAULICS.** For Technical Students. By F. C. LEA, D.Sc., M.Inst.C.E. viii + 224 pages, with 156 diagrams. Crown 8vo, 7s. 6d.

**MODERN METHODS OF WATER PURIFICATION.** By JOHN DON, F.I.C., A.M.I.Mech.E., and JOHN CRISHOLM, A.M.I.Mech.E. SECOND EDITION. xviii + 398 pages, 106 illustrations. Demy 8vo, 16s. net.

**REINFORCED CONCRETE DESIGN.** VOL. I.: THEORY. By OSCAR FABER, D.Sc., M.Inst.C.E., and P. G. BOWIE, A.M.Inst.C.E. xx + 332 pages, 158 diagrams. SECOND EDITION. Demy 8vo, 14s. net. VOL. II.: PRACTICE. By OSCAR FABER, D.Sc., M.Inst.C.E. xii + 246 pages, 89 diagrams. Demy 8vo, 18s. net.

LONDON: EDWARD ARNOLD & CO., 41 & 43 MADDOX ST., W.1.



**MODERN ROADS.** By H. P. BOULNOIS, M.Inst.C.E., F.R.San.Inst., etc. xii + 302 pages Demy 8vo, 16s. net.

**SURVEYING.** By Professor W. N. THOMAS, M.Sc. (Birmingham), B.Sc. Eng. (London), Assoc.M.Inst.C.E., A.M.I.Mech.E., A.M.Inst. M. and Cy.E. SECOND EDITION. viii + 536 pages and 298 diagrams. 8vo, 25s. net.

**THE FIELD ENGINEER'S HANDBOOK.** By G. C. WELLS and A. S. CLAY, B.Sc. SECOND EDITION. Small 8vo, 8s. 6d. net.

**TRAVERSE TABLES.** By HENRY LOUIS, M.A., D.Sc., M.I.C.E., and G. W. CAUNT, M.A. SECOND EDITION. 8vo, 5s. 6d. net.

**TACHEOMETER TABLES.** By H. LOUIS, M.A., D.Sc., M.I.C.E., and G. W. CAUNT, M.A. 8vo, 10s. 6d. net.

**A TEXT-BOOK OF ELECTRICAL ENGINEERING.** By Dr. A. THOMÄLEN. Translated by Professor G. W. O. HOWE, D.Sc. FOURTH EDITION. xii + 482 pages, 480 diagrams. Demy 8vo, 28s. net.

**THE PRINCIPLES OF ELECTRICAL ENGINEERING AND THEIR APPLICATION.** By Dr. G. KAPP. VOLUME I.: PRINCIPLES. xii + 356 pages. Demy 8vo, 18s. net. VOLUME II.: APPLICATION. x + 388 pages. 18s. net.

**THE THEORY OF MACHINES.** By R. F. MCKAY, M.Sc., A.M.Inst. C.E. SECOND EDITION. viii + 440 pages, 407 diagrams. Demy 8vo, 20s. net.

**GRINDING MACHINERY.** By J. J. GUEST, M.A., M.I.Mech.E. xii + 444 pages, with illustrations. Demy 8vo, 16s. net.

**METAL WORK.** By H. M. ADAM and J. H. EVANS. SECOND EDITION. 277 pages, with 217 illustrations. Crown 8vo. Cloth, 6s. 6d.

**THE STRENGTH AND ELASTICITY OF STRUCTURAL MEMBERS.** By R. J. WOODS, M.E., M.Inst.C.E. SECOND EDITION. xii + 310 pages, 292 illustrations. Demy 8vo, 14s. net.

**EXAMPLES IN THE STRENGTH AND ELASTICITY OF MATERIALS.** By G. W. BIRD, B.Sc. Crown 8vo. 10s. 6d. net.

**THE THEORY OF STRUCTURES.** By R. J. WOODS, M.E., M.Inst. C.E. xii + 276 pages, 157 illustrations. Demy 8vo, 12s. 6d. net.

**THE ITALIAN ORDERS OF ARCHITECTURE.** By CHARLES GOURLAV, B.Sc., A.R.I.B.A. Large 4to. SECOND EDITION. 8s. net.

**AN INTRODUCTION TO BUILDING SCIENCE.** By F. L. BRADY, M.Sc., A.I.C. Crown 8vo, viii + 280 pages, with 63 illustrations. 7s. 6d.

**MECHANICAL DRAWING.** With Special Reference to the Needs of Mining Students. By JOSEPH HUSBAND, B.Eng., A.M.I.C.E., Professor of Civil Engineering at Sheffield University. With 40 plates. Quarto, 3s. 6d.

**MACHINE SKETCHES AND DESIGNS.** By Professor A. CRUICKSHANK, M.I.Mech.E., and R. F. MCKAY, M.Sc., A.M.Inst.C.E. THIRD EDITION. Quarto, 2s. 6d.

**FIRST YEAR ELECTRICAL ENGINEERING.** By D. J. BOLTON, M.Sc., M.I.E.E., Lecturer at the Polytechnic, London. xii + 260 pages, with 118 diagrams. Crown 8vo, 5s.

**EXAMPLES IN ELECTRICAL ENGINEERING.** By J. F. GILL, M.Sc., B.Eng., A.M.I.Mech.E.; and Professor F. J. TRAGO, D.Sc., M.I.E.E., The University, Liverpool. SECOND EDITION. Crown 8vo, 7s. 6d. net.

LONDON: EDWARD ARNOLD & CO., 41 & 43 MADDOX ST., W.1.

## GEOLOGY AND MINING

**THE GEOLOGY OF THE BRITISH EMPIRE.** By F. R. C. REED, Sc.D., F.G.S. viii + 480 pages, with 25 maps and sections. Demy 8vo, 30s. net.

**THE STRUCTURE OF THE ALPS.** By L. W. COLLET, D.Sc. xii + 282 pages, with 63 figures and 12 plates. Demy 8vo, 16s. net.

**STRUCTURE AND SURFACE. A Book of Field Geology.** By C. BARRINGTON BROWN, M.A., F.G.S., and F. DEBENHAM, M.A., F.G.S. viii + 168 pages, with 104 illustrations. Medium 8vo, 10s. 6d. net.

**PHYSICO-CHEMICAL GEOLOGY.** By R. H. RASTALL, Sc.D., Lecturer in Economic Geology in the University of Cambridge. viii + 48 pages, with 62 diagrams. 15s. net.

**OIL FINDING: An Introduction to the Geological Study of Petroleum.** By E. H. CUNNINGHAM CRAIG, B.A., F.G.S. SECOND EDITION. xii + 324 pages, 13 plates and 20 illustrations. Demy 8vo, cloth, 16s. net.

**THE DRESSING OF MINERALS.** By H. LOUIS, D.Sc., M.I.M.E., M.Inst.C.E. x + 544 pages, 416 illustrations. Super royal 8vo, cloth, 30s. net.

**COAL IN GREAT BRITAIN.** By WALCOT GIBSON, D.Sc., F.G.S., F.R.S.E. SECOND EDITION. viii + 312 pages, with 50 diagrams and 8 plates. Demy 8vo, 21s. net.

**COAL MEASURE PLANTS.** By R. CROOKALL, Ph.D., of the Geological Survey of Great Britain. Medium 8vo, with 40 plates. 12s. 6d. net.

**THE ECONOMICS OF COAL MINING.** By R. W. DRON, M.A., F.R.S.E., Professor of Mining in the University of Glasgow. viii + 168 pages, with 13 figures and 26 tables. Demy 8vo, 10s. 6d. net.

**MINING SUBSIDENCE.** By HENRY BRIGGS, C.B.E., D.Sc., Professor of Mining in the University of Edinburgh. Demy 8vo. viii + 216 pages. 14s. net.

**WINDING ENGINES AND WINDING APPLIANCES: Their Design and Economical Working.** By G. McCULLOCH, A.M.I.M.E., and T. C. FUTERS, M.Inst.M.E. viii + 452 pages, 175 illustrations. Demy 8vo, 21s. net.

**A TEXTBOOK OF GEOLOGY.** By P. LAKE, M.A., F.G.S., and R. H. RASTALL, Sc.D., F.G.S. xiv + 508 pages, fully illustrated. FOURTH EDITION. Demy 8vo, 21s. net.

**OUTLINES OF PALÆONTOLOGY.** By H. H. SWINNERTON, D.Sc., F.G.S. xii + 420 pages, with 368 diagrams. Demy 8vo, cloth, 30s. net.

**THE PHYSIOGRAPHICAL EVOLUTION OF BRITAIN.** By L. J. WILLS, Sc.D., F.G.S., Lecturer in Geology in the University of Birmingham. viii + 368 pages, with 154 diagrams and 3 folding maps. Demy 8vo, 21s. net.

**A STUDY OF THE OCEANS.** By JAMES JOHNSTONE, D.Sc. SECOND EDITION. viii + 235 pages, with 44 illustrations. Demy 8vo. 10s. 6d. net.

**THE GEOLOGY OF ORE DEPOSITS.** By H. H. THOMAS, M.A., B.Sc., and D. A. MACALISTER, A.R.S.M. Crown 8vo, 8s. 6d. net.

**THE GEOLOGY OF BUILDING STONES.** By J. ALLEN HOWE, B.Sc. viii + 455 pages, fully illustrated. Crown 8vo, 8s. 6d. net.

**THE GEOLOGY OF SOILS AND SUBSTRATA.** By the late H. B. WOODWARD, F.R.S. xvi + 366 pages, with illustrations. Crown 8vo, 8s. 6d. net.

**GEOLOGICAL AND TOPOGRAPHICAL MAPS: Their Interpretation and Use.** By A. R. DWERRYHOUSE, D.Sc., F.G.S. SECOND EDITION. viii + 133 pages, with 90 illustrations. Demy 8vo, 6s. net.

**THEORY AND PRACTICE OF MINE VENTILATION.** By T. BRYSON, M.I.Min.E. viii + 255 pages, with 81 illustrations. Crown 8vo., 8s. 6d.

LONDON: EDWARD ARNOLD & CO., 41 & 43 MADDOX ST., W.1.

## CHEMISTRY AND METALLURGY

**THE DISCOVERY OF THE RARE GASES.** By MORRIS W. TRAVERS, D.Sc., F.R.S. viii + 128 pages, with facsimile reproductions from Sir William Ramsay's Notebooks. Demy 4to, 15s. net.

**THE ORDINALL OF ALCHIMY.** Written by THOMAS NORTON of Bristol. Facsimile Reproduction from *Theatrum Chemicum Britannicum*. viii + 125 pages. Demy 8vo, 10s. 6d. net.

**AN ETYMOLOGICAL DICTIONARY OF CHEMISTRY AND MINERALOGY.** By DOROTHY BAILEY, B.Sc., Ph.D., and KENNETH C. BAILEY, M.A., Sc.D. xii + 292 pages. Demy 8vo, 25s. net.

**THE ELDER PLINY'S CHAPTERS ON CHEMICAL SUBJECTS.** Translated with a critical commentary by KENNETH C. BAILEY, M.A., Sc.D. 249 pages. Royal 8vo, 12s. 6d. net.

**METALS AND METALLIC COMPOUNDS.** By U. R. EVANS, M.A., King's College, Cambridge. 4 vols., obtainable separately. Demy 8vo. Vol. I, 21s. net. Vol. II, 18s. net. Vol. III, 14s. net. Vol. IV, 18s. net.

**THE CORROSION OF METALS.** By U. R. EVANS, M.A. SECOND EDITION. Demy 8vo. xvi + 259 pages. 15s. net.

**A BIBLIOGRAPHY OF METALLIC CORROSION.** By W. H. J. VERNON, D.Sc., F.I.C. xii + 341 pages. Demy 8vo, 21s. net.

**SERVICE CHEMISTRY.** By the late VIVIAN B. LEWES, F.I.C., F.C.S.; and J. S. S. BRAME, C.B.E., F.I.C., Professor of Chemistry, Royal Naval College, Greenwich. FIFTH EDITION. xvi + 576 pages. Illustrated. Demy 8vo, 21s.

**FUEL. Solid, Liquid, and Gaseous.** By J. S. S. BRAME, C.B.E. THIRD EDITION. xvi + 388 pages, 73 diagrams. Demy 8vo, 18s. net.

**PETROL AND PETROLEUM SPIRITS. A Description of their Sources, Preparation, Examination, and Uses.** By W. E. GOODAY, A.R.S.M., D.I.C., A.M.Inst.P.T. xii + 135 pages. Demy 8vo, 10s. 6d. net.

**THE ABSORPTION OF NITROUS GASES.** By H. W. WEBB, M.Sc., F.I.C. Demy 8vo, 25s. net.

**THE RARE EARTHS: Their Occurrence, Chemistry and Technology.** By S. I. LEVY, M.A., F.I.C. xvi + 362 pages. Demy 8vo, 18s. net.

**THE CHEMISTRY AND MANUFACTURE OF HYDROGEN.** By P. LITHERLAND TEED, A.R.S.M. Illustrated. Demy 8vo, cloth, 10s. 6d. net.

**THE PRINCIPLES OF APPLIED ELECTRO-CHEMISTRY.** By A. J. ALLMAND, D.Sc., Professor of Chemistry, King's College, London, and H. J. T. ELLINGHAM, B.Sc. SECOND EDITION. Medium 8vo. xii + 727 pages and 171 diagrams. 35s. net.

**ANTIQUES: Their Restoration and Preservation.** By A. LUCAS, F.I.C. Crown 8vo, 6s. net.

**ANCIENT EGYPTIAN MATERIALS.** By A. LUCAS, F.I.C. Crown 8vo, 7s. 6d. net.

**AN INTRODUCTION TO ORGANIC CHEMISTRY.** By E. J. HOLMYARD, D.Litt., F.I.C. viii + 282 pages. Crown 8vo. 4s. 6d.

**OUTLINES OF ORGANIC CHEMISTRY.** By E. J. HOLMYARD, D.Litt., F.I.C. viii + 456 pages. Crown 8vo, 7s. 6d.

LONDON: EDWARD ARNOLD & CO., 41 & 43 MADDOX ST., W.1.

**ORGANIC CHEMISTRY FOR ADVANCED STUDENTS.** By JULIUS B. COHEN, Ph.D., D.Sc., F.R.S. FIFTH EDITION, in Three Parts, obtainable separately. Demy 8vo, 18s net each part.

**THE CONSTITUTION OF SUGARS.** By W. N. HAWORTH, D.Sc., F.R.S., Professor of Chemistry in the University of Birmingham. viii + 100 pages with 2 plates. Medium 8vo, 8s. 6d. net.

**BIO-CHEMISTRY.** A Study of the Origin, Reactions, and Equilibria of Living Matter. By the late BENJAMIN MOORE, M.A., D.Sc., F.R.S. viii + 340 pages. Demy 8vo, 21s. net.

**CHEMICAL DISINFECTION AND STERILIZATION.** By S. RIDEAL, D.Sc., F.I.C., and E. K. RIDEAL, M.A., D.Sc., F.I.C. 321 pages. Demy 8vo, 21s. net.

**SMOKE.** A Study of Town Air. By Prof. J. B. COHEN, F.R.S., and Dr. A. G. RUSHTON. SECOND EDITION, with 15 plates. Demy 8vo, 8s. 6d. net.

**THE EVOLUTION AND DEVELOPMENT OF THE QUANTUM THEORY.** By N. M. BLIGH, A.R.C.S. Demy 8vo, 9s. net.

**THE PROBLEM OF PHYSICO-CHEMICAL PERIODICITY.** By E. S. HEDGES, Ph.D., and J. E. MYERS, O.B.E., D.Sc. Demy 8vo, 7s. 6d. net.

**PHYSICAL CHEMISTRY: its Bearing on Biology and Medicine.** By J. C. PHILIP, D.Sc., F.R.S., Professor of Physical Chemistry in the Imperial College of Science and Technology. THIRD EDITION. Crown 8vo, 8s. 6d. net.

**ELEMENTARY PHYSICAL CHEMISTRY.** By W. H. BARRETT, M.A., Harrow School. viii + 247 pages, with 61 diagrams. 6s.

**THE CHEMISTRY OF COLLOIDS and some Technical Applications.** By W. W. TAYLOR, M.A., D.Sc., Lecturer in Chemical Physiology in the University of Edinburgh. SECOND EDITION. Crown 8vo, 10s. 6d. net.

**PRACTICAL PHOTOMICROGRAPHY.** By J. E. BARNARD, F.R.S., and F. V. WELCH, F.R.M.S. SECOND EDITION. xii + 316 pages, with 87 illustrations and 16 plates. Demy 8vo. Cloth, 18s. net.

**ANALYTICAL MICROSCOPY.** By T. E. WALLIS, B.Sc., Reader in Pharmacognosy in London University. viii + 150 pages. Illustrated. Crown 8vo, cloth, 6s. net.

**AN INORGANIC CHEMISTRY.** By H. G. DENHAM, M.A., D.Sc., Ph.D., Professor of Chemistry in the University of New Zealand. xii + 688 pages, with 144 diagrams. SECOND EDITION. Crown 8vo, 12s. 6d. net.

**INORGANIC CHEMISTRY. A Textbook for Colleges and Schools.** By E. J. HOLMYARD, D.Litt., Head of the Science Department, Clifton College. viii + 564 pages, with 119 diagrams and 10 plates. Crown 8vo, 6s. 6d.

**ANALYTICAL PROCESSES: A Physico-Chemical Interpretation.** By T. B. SMITH, B.Sc., A.R.C.S., The University, Sheffield. viii + 373 pages, with 51 diagrams. Demy 8vo, 12s. 6d. net.

**INTERMEDIATE PRACTICAL CHEMISTRY.** By E. S. HEDGES, D.Sc., Bedford College, University of London. 128 pages. Demy 8vo, 5s.

**A HANDBOOK OF ORGANIC ANALYSIS: QUALITATIVE AND QUANTITATIVE.** By H. T. CLARKE, B.Sc., A.I.C. xvi + 363 pages. FOURTH EDITION. Crown 8vo, 8s. 6d. net.

**AN ELEMENTARY CHEMISTRY.** By E. J. HOLMYARD, D.Litt. viii + 430 pages. SECOND EDITION. Crown 8vo, 5s.

**FIRST AID IN THE LABORATORY AND WORKSHOP.** By A. A. ELDRIDGE, B.Sc., and H. V. A. BRISCOE, D.Sc. Cloth, 1s. 3d. net.

LONDON: EDWARD ARNOLD & CO., 41 & 43 MADDOX ST., W.1.

## BIOLOGY

**FOUNDERS OF OCEANOGRAPHY AND THEIR WORK.** By Sir WILLIAM HERDMAN, C.B.E., F.R.S. xii + 340 pages, 29 plates. Demy 8vo, 21s. net.

**MANUAL OF ENTOMOLOGY.** By the late H. MAXWELL LEFRO M.A. xvi + 552 pages. Fully illustrated. Demy 8vo, 35s. net.

**BRITISH HYMENOPTERA.** By A. S. BUCKHURST, D.I.C., L. N. STANLAND, D.I.C., and G. B. WATSON, D.I.C. Crown 4to, 9s. net.

**AN INTRODUCTION TO PHYSICAL ANTHROPOLOGY.** By E. P. SIBBLE, F.R.C.S. viii + 200 pages, with 42 diagrams and 1 coloured map. Demy 8vo. 12s. 6d. net.

**MAN'S PLACE AMONG THE MAMMALS.** By F. WOOD JONES, F.R.S., Demy 8vo. viii + 376 pages, with 170 illustrations. 21s. net.

**THE ANIMAL MIND.** By C. LLOYD MORGAN, D.Sc., F.R.S. Demy 8vo.

**THE MECHANISM OF LIFE.** In Relation to Modern Physical Theory. By J. JOHNSTONE, D.Sc. xii + 248 pages, with 53 diagrams. Demy 8vo, 15s. net.

**THE PROGRESS OF LIFE.** A Study in Psychogenetic Evolution. By ALEXANDER MEEK, D.Sc. viii + 193 pages, with illustrations. Demy 8vo. 10s. 6d. net.

**THE MIGRATIONS OF FISH.** By ALEXANDER MEEK, D.Sc. With illustrations and maps. xx + 428 pages. Demy 8vo, 18s. net.

**AN INTRODUCTION TO THE SCIENTIFIC STUDY OF THE SOIL.** By N. M. COMBER, D.Sc. Crown 8vo, 192 pages, 7s. 6d. net.

**THE SCIENTIFIC PRINCIPLES OF PLANT PROTECTION.** By HUBERT MARTIN, M.Sc. xii + 310 pages. Demy 8vo, 21s. net.

**ANIMAL LIFE IN DESERTS.** By P. A. BUXTON, M.A. xvi + 172 pages, with 14 plates. Demy 8vo, 10s. 6d. net.

**GROWTH.** By G. R. DE BEER, B.A., B.Sc. Demy 8vo, 7s. 6d. net.

**PRINCIPLES OF BACTERIOLOGY AND IMMUNITY.** By W. W. C. TOPLEY, M.A., M.D., F.R.S., and G. S. WILSON, M.D., B.S. 1360 pages, with 242 illustrations. Super royal. In two volumes. 50s. net per set.

**AN INTRODUCTION TO THE STUDY OF THE PROTOZOA.** With special reference to the Parasitic Forms. By the late B. A. MINCHIN, M.A., Ph.D., F.R.S. xii + 520 pages, 194 diagrams. Demy 8vo, 25s. net.

**THE DEVELOPMENT OF BRITISH FORESTRY.** By A. C. FORBES, F.H.A.S. xii + 274 pages, 70 illustrations. Demy 8vo, 10s. 6d. net.

**PROCEEDINGS OF THE WORLD POPULATION CONFERENCE, 1927.** Edited by MARGARET SANGER. 383 pages. Medium 8vo. 20s. net.

**A HANDBOOK OF THE CONIFERÆ AND GINKGOACEÆ.** By W. DALLIMORE and A. B. JACKSON. With 32 plates and 120 diagrams. Medium 8vo, cloth, 42s. net.

**A BRITISH GARDEN FLORA.** By Lt.-Col. J. W. C. KIRK, B.A., F.R.H.S., with a foreword by Dr. A. W. HILL, C.M.G., F.R.S. xii + 592 pages, with 223 diagrams. Medium 8vo, 42s. net.

**ELEMENTARY BOTANY.** An Introduction to the Study of Plant Life. By W. WATSON, D.Sc. viii + 368 pages, with 225 diagrams. Crown 8vo, 6s. 6d. net.

LONDON: EDWARD ARNOLD & CO., 41 & 43 MADDOX ST., W.1.

